MATHEMATICS RESOURCES
GCSE MATHEMATICS

Contents

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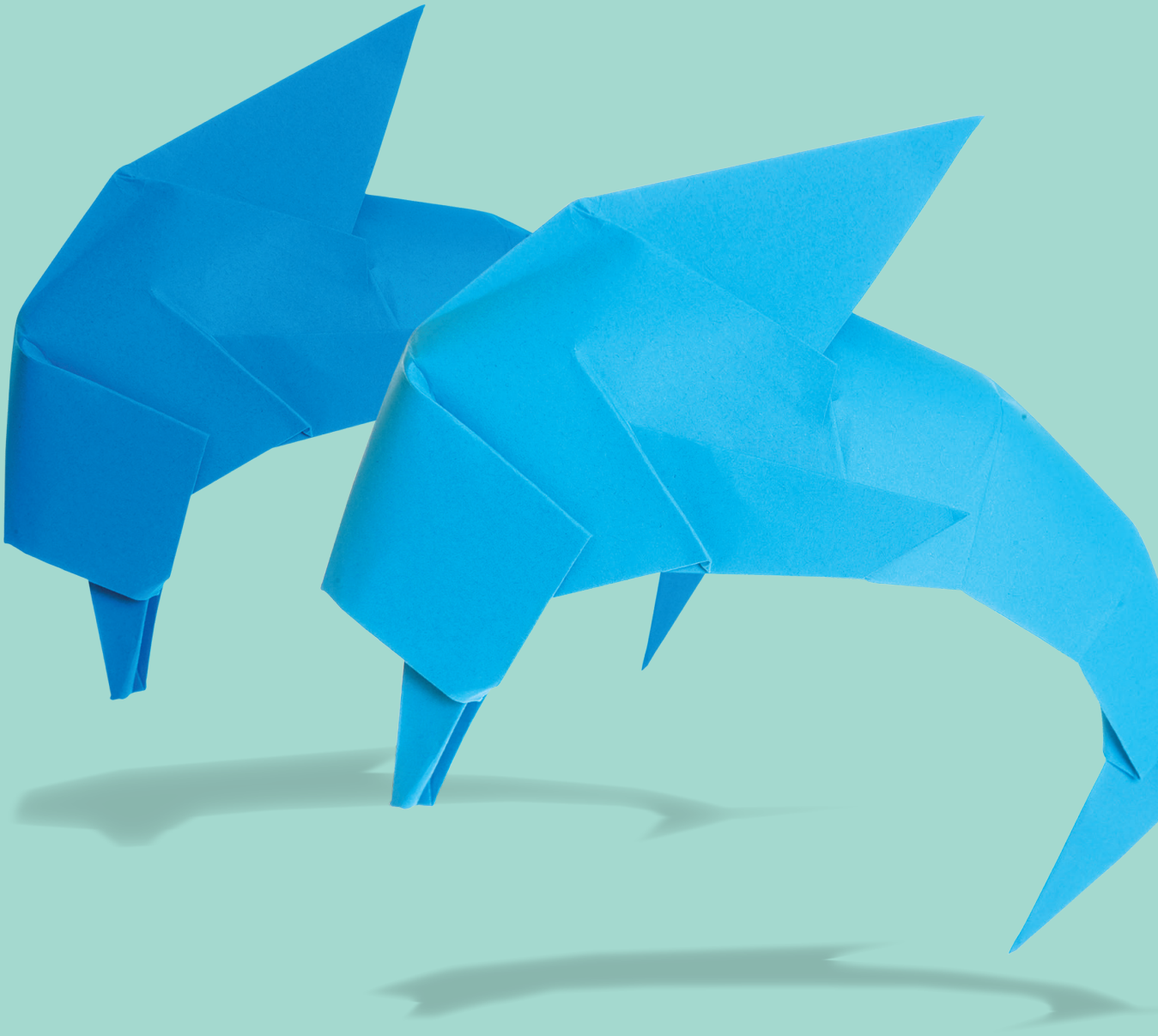
GCSE (9-1) Mathematics



Specification

Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Mathematics (1MA1)

First teaching from September 2015

First certification from June 2017 | Issue 2

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Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Mathematics (1MA1)

Specification

First certification 2017

Issue 2

Edexcel, BTEC and LCCI qualifications

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From Pearson's Expert Panel for World Class Qualifications

"The reform of the qualifications system in England is a profoundly important change to the education system. Teachers need to know that the new qualifications will assist them in helping their learners make progress in their lives.

When these changes were first proposed we were approached by Pearson to join an 'Expert Panel' that would advise them on the development of the new qualifications.

We were chosen, either because of our expertise in the UK education system, or because of our experience in reforming qualifications in other systems around the world as diverse as Singapore, Hong Kong, Australia and a number of countries across Europe.

We have guided Pearson through what we judge to be a rigorous qualification development process that has included:

- Extensive international comparability of subject content against the highest-performing jurisdictions in the world
- Benchmarking assessments against UK and overseas providers to ensure that they are at the right level of demand
- Establishing External Subject Advisory Groups, drawing on independent subject-specific expertise to challenge and validate our qualifications
- Subjecting the final qualifications to scrutiny against the DfE content and Ofqual accreditation criteria in advance of submission.

Importantly, we have worked to ensure that the content and learning is future oriented. The design has been guided by what is called an 'Efficacy Framework', meaning learner outcomes have been at the heart of this development throughout.

We understand that ultimately it is excellent teaching that is the key factor to a learner's success in education. As a result of our work as a panel we are confident that we have supported the development of qualifications that are outstanding for their coherence, thoroughness and attention to detail and can be regarded as representing world-class best practice."

Sir Michael Barber (Chair)

Chief Education Advisor, Pearson plc

Bahram Bekhradnia

President, Higher Education Policy Institute

Dame Sally Coates

Principal, Burlington Danes Academy

Professor Robin Coningham

Pro-Vice Chancellor, University of Durham

Dr Peter Hill

Former Chief Executive ACARA

Professor Sing Kong Lee

Director, National Institute of Education, Singapore

Professor Jonathan Osborne

Stanford University

Professor Dr Ursula Renold

Federal Institute of Technology, Switzerland

Professor Bob Schwartz

Harvard Graduate School of Education

Introduction

The Pearson Edexcel Level 1/Level 2 GCSE (9 to 1) in Mathematics is designed for use in schools and colleges. It is part of a suite of GCSE qualifications offered by Pearson.

Purpose of the specification

This specification sets out:

- the objectives of the qualification
- any other qualification that a student must have completed before taking the qualification
- any prior knowledge and skills that the student is required to have before taking the qualification
- any other requirements that a student must have satisfied before they will be assessed or before the qualification will be awarded
- the knowledge and understanding that will be assessed as part of the qualification
- the method of assessment and any associated requirements relating to it
- the criteria against which a student's level of attainment will be measured (such as assessment criteria).

Rationale

The Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Mathematics meets the following purposes, which fulfil those defined by the Office of Qualifications and Examinations Regulation (Ofqual) for GCSE qualifications in their *GCSE (9 to 1) Qualification Level Conditions and Requirements* document, published in April 2014.

The purposes of this qualification are to:

- provide evidence of students' achievements against demanding and fulfilling content, to give students the confidence that the mathematical skills, knowledge and understanding that they will have acquired during the course of their study are as good as that of the highest performing jurisdictions in the world
- provide a strong foundation for further academic and vocational study and for employment, to give students the appropriate mathematical skills, knowledge and understanding to help them progress to a full range of courses in further and higher education. This includes Level 3 mathematics courses as well as Level 3 and undergraduate courses in other disciplines such as biology, geography and psychology, where the understanding and application of mathematics is crucial
- provide (if required) a basis for schools and colleges to be held accountable for the performance of all of their students.

Qualification aims and objectives

The aims and objectives of the Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Mathematics are to enable students to:

- develop fluent knowledge, skills and understanding of mathematical methods and concepts
- acquire, select and apply mathematical techniques to solve problems
- reason mathematically, make deductions and inferences, and draw conclusions
- comprehend, interpret and communicate mathematical information in a variety of forms appropriate to the information and context.

The context for the development of this qualification

All our qualifications are designed to meet our World Class Qualification Principles[1] and our ambition to put the student at the heart of everything we do.

We have developed and designed this qualification by:

- reviewing other curricula and qualifications to ensure that it is comparable with those taken in high-performing jurisdictions overseas
- consulting with key stakeholders on content and assessment, including learned bodies, subject associations, higher-education academics, teachers and employers to ensure this qualification is suitable for a UK context
- reviewing the legacy qualification and building on its positive attributes.

This qualification has also been developed to meet criteria stipulated by Ofqual in their documents *GCSE (9 to 1) Qualification Level Conditions and Requirements* and *GCSE Subject Level Conditions and Requirements for Mathematics*, published in April 2014.

[1] Pearson's World Class Qualification principles ensure that our qualifications are:

- **demanding**, through internationally benchmarked standards, encouraging deep learning and measuring higher-order skills
- **rigorous**, through setting and maintaining standards over time, developing reliable and valid assessment tasks and processes, and generating confidence in end users of the knowledge, skills and competencies of certified students
- **inclusive**, through conceptualising learning as continuous, recognising that students develop at different rates and have different learning needs, and focusing on progression
- **empowering**, through promoting the development of transferable skills, see *Appendix 1*.

Contents

Qualification at a glance

Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Mathematics

- The assessments will cover the following content headings:
  1 Number
  2 Algebra
  3 Ratio, proportion and rates of change
  4 Geometry and measures
  5 Probability
  6 Statistics
- Two tiers are available: Foundation and Higher (content is defined for each tier).
- Each student is permitted to take assessments in either the Foundation tier or Higher tier.
- The qualification consists of three equally-weighted written examination papers at either Foundation tier or Higher tier.
- All three papers must be at the same tier of entry and must be completed in the same assessment series.
- Paper 1 is a non-calculator assessment and a calculator is allowed for Paper 2 and Paper 3.
- Each paper is 1 hour and 30 minutes long.
- Each paper has 80 marks.
- The content outlined for each tier will be assessed across all three papers.
- Each paper will cover all Assessment Objectives, in the percentages outlined for each tier. (See the section *Breakdown of Assessment Objectives* for more information.)
- Each paper has a range of question types; some questions will be set in both mathematical and non-mathematical contexts.
- See *Appendix 3* for a list of formulae that can be provided in the examination (as part of the relevant question).
- Two assessment series available per year: May/June and November*.
- First assessment series: May/June 2017.
- The qualification will be graded and certificated on a nine-grade scale from 9 to 1 using the total mark across all three papers where 9 is the highest grade. Individual papers are not graded.
- Foundation tier: grades 1 to 5.
- Higher tier: grades 4 to 9 (grade 3 allowed).

*See the *November resits* section for restrictions on November entry.

Knowledge, skills and understanding

Overview

The table below illustrates the topic areas covered in this qualification and the topic area weightings for the assessment of the Foundation tier and the assessment of the Higher tier.

Tier	Topic area	Weighting
Foundation	Number	22 - 28%
	Algebra	17 - 23%
	Ratio, Proportion and Rates of change	22 - 28%
	Geometry and Measures	12 - 18%
	Statistics & Probability	12 - 18%
Higher	Number	12 - 18%
	Algebra	27 - 33%
	Ratio, Proportion and Rates of change	17 - 23%
	Geometry and Measures	17 - 23%
	Statistics & Probability	12 - 18%

Content

- All students will develop confidence and competence with the content identified by standard type.
- All students will be assessed on the content identified by the standard and the underlined type; more highly attaining students will develop confidence and competence with all of this content.
- Only the more highly attaining students will be assessed on the content identified by **bold** type. The highest attaining students will develop confidence and competence with the bold content.
- The distinction between standard, underlined and **bold** type applies to the content statements only, not to the Assessment Objectives or to the mathematical formulae.

Foundation tier

Foundation tier students will be assessed on content identified by the standard and underlined type. Foundation tier students will **not** be assessed on content identified by **bold** type. Foundation tier content is on *pages 3–9*.

Higher tier

Higher tier students will be assessed on **all** the content which is identified by the standard, underlined and **bold** type. Higher tier content is on *pages 10–18*.

Foundation tier knowledge, skills and understanding

1. Number

Structure and calculation

What students need to learn:

N1 order positive and negative integers, decimals and fractions; use the symbols $=, \neq, <, >, \leq, \geq$

N2 apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative; understand and use place value (e.g. when working with very large or very small numbers, and when calculating with decimals)

N3 recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions); use conventional notation for priority of operations, including brackets, powers, roots and reciprocals

N4 use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem

N5 apply systematic listing strategies

N6 use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5

N7 calculate with roots, and with integer indices

N8 calculate exactly with fractions and multiples of π

N9 calculate with and interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer

Fractions, decimals and percentages

What students need to learn:

N10 work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $\frac{7}{2}$ or 0.375 or $\frac{3}{8}$)

N11 identify and work with fractions in ratio problems

N12 interpret fractions and percentages as operators

Measures and accuracy

What students need to learn:

N13 use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate

N14 estimate answers; check calculations using approximation and estimation, including answers obtained using technology

N15 round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures); use inequality notation to specify simple error intervals due to truncation or rounding

N16 apply and interpret limits of accuracy

2. Algebra

Notation, vocabulary and manipulation

What students need to learn:

A1 use and interpret algebraic manipulation, including:

- ab in place of $a \times b$
- $3y$ in place of $y + y + y$ and $3 \times y$
- a^2 in place of $a \times a$, a^3 in place of $a \times a \times a$, a^2b in place of $a \times a \times b$
- $\frac{a}{b}$ in place of $a \div b$
- coefficients written as fractions rather than as decimals
- brackets

A2 substitute numerical values into formulae and expressions, including scientific formulae

A3 understand and use the concepts and vocabulary of expressions, equations, formulae, identities, inequalities, terms and factors

A4 simplify and manipulate algebraic expressions (including those involving surds) by:

- collecting like terms
- multiplying a single term over a bracket
- taking out common factors
- expanding products of two binomials
- factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares;
- simplifying expressions involving sums, products and powers, including the laws of indices

A5 understand and use standard mathematical formulae; rearrange formulae to change the subject

A6 know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments

A7 where appropriate, interpret simple expressions as functions with inputs and outputs.

Graphs

What students need to learn:

A8 work with coordinates in all four quadrants

A9 plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form $y = mx + c$ to identify parallel lines; find the equation of the line through two given points or through one point with a given gradient

A10 identify and interpret gradients and intercepts of linear functions graphically and algebraically

A11 identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically

A12 recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$

A14 plot and interpret graphs (including reciprocal graphs) and graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration

Solving equations and inequalities

What students need to learn:

A17 solve linear equations in one unknown algebraically (including those with the unknown on both sides of the equation); find approximate solutions using a graph

A18 solve quadratic equations algebraically by factorising; find approximate solutions using a graph

A19 solve two simultaneous equations in two variables (linear/linear algebraically; find approximate solutions using a graph

A21 translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution

A22 solve linear inequalities in one variable; represent the solution set on a number line

Sequences

What students need to learn:

A23 generate terms of a sequence from either a term-to-term or a position-to-term rule

A24 recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r^n where n is an integer, and r is a rational number > 0)

A25 deduce expressions to calculate the nth term of linear sequences

3. Ratio, proportion and rates of change

What students need to learn:

R1 change freely between related standard units (e.g. time, length, area, volume/capacity, mass) and compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts

R2 use scale factors, scale diagrams and maps

R3 express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1

R4 use ratio notation, including reduction to simplest form

R5 divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)

R6 express a multiplicative relationship between two quantities as a ratio or a fraction

R7 understand and use proportion as equality of ratios

R8 relate ratios to fractions and to linear functions

R9 define percentage as 'number of parts per hundred'; interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; express one quantity as a percentage of another; compare two quantities using percentages; work with percentages greater than 100%; solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics

R10 solve problems involving direct and inverse proportion, including graphical and algebraic representations

R11 use compound units such as speed, rates of pay, unit pricing, density and pressure

R12 compare lengths, areas and volumes using ratio notation; make links to similarity (including trigonometric ratios) and scale factors

R13 understand that X is inversely proportional to Y is equivalent to X is proportional to $\frac{1}{Y}$; interpret equations that describe direct and inverse proportion

R14 interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion

R16 set up, solve and interpret the answers in growth and decay problems, including compound interest

4. Geometry and measures

Properties and constructions

What students need to learn:

G1 use conventional terms and notation: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries; use the standard conventions for labelling and referring to the sides and angles of triangles; draw diagrams from written description

G2 use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line

G3 apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)

G4 derive and apply the properties and definitions of special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles and other plane figures using appropriate language

G5 use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)

G6 apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs

G7 identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (including fractional scale factors)

G9 identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment

G11 solve geometrical problems on coordinate axes

G12 identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres

G13 construct and interpret plans and elevations of 3D shapes

Mensuration and calculation

What students need to learn:

G14 use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc.)

G15 measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings

G16 know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids and other right prisms (including cylinders)

G17 know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2; calculate: perimeters of 2D shapes, including circles; areas of circles and composite shapes; surface area and volume of spheres, pyramids, cones and composite solids

G18 calculate arc lengths, angles and areas of sectors of circles

G19 apply the concepts of congruence and similarity, including the relationships between lengths, in similar figures

G20 know the formulae for: Pythagoras' theorem $a^2 + b^2 = c^2$, and the trigonometric ratios, $\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$, $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$ and $\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$; apply them to find angles and lengths in right-angled triangles in two-dimensional figures

G21 know the exact values of $\sin\theta$ and $\cos\theta$ for $\theta = 0°, 30°, 45°, 60°$ and $90°$; know the exact value of $\tan\theta$ for $\theta = 0°, 30°, 45°$ and $60°$

Vectors

What students need to learn:

G24 describe translations as 2D vectors

G25 apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors

5. Probability

What students need to learn:

P1 record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees

P2 apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments

P3 relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale

P4 apply the property that the probabilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one

P5 understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size

P6 enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams and tree diagrams

P7 construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities

P8 calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions

6. Statistics

What students need to learn:

S1 infer properties of populations or distributions from a sample, while knowing the limitations of sampling

S2 interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data and know their appropriate use

S4 interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:

- appropriate graphical representation involving discrete, continuous and grouped data
- appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers)

S5 apply statistics to describe a population

S6 use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends while knowing the dangers of so doing

Higher tier knowledge, skills and understanding

1. Number

Structure and calculation

What students need to learn:

N1 order positive and negative integers, decimals and fractions; use the symbols $=, \neq, <, >, \leq, \geq$

N2 apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative; understand and use place value (e.g. when working with very large or very small numbers, and when calculating with decimals)

N3 recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions); use conventional notation for priority of operations, including brackets, powers, roots and reciprocals

N4 use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem

N5 apply systematic listing strategies, **including use of the product rule for counting (i.e. if there are m ways of doing one task and for each of these, there are n ways of doing another task, then the total number of ways the two tasks can be done is $m \times n$ ways)**

N6 use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5*;* **estimate powers and roots of any given positive number**

N7 calculate with roots, and with integer **and fractional** indices

N8 calculate exactly with fractions, **surds** and multiples of π*;*
simplify surd expressions involving squares (e.g. $\sqrt{12} = \sqrt{(4 \times 3)} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$) and rationalise denominators

N9 calculate with and interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer

Fractions, decimals and percentages

What students need to learn:

N10 work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $\frac{7}{2}$ or 0.375 or $\frac{3}{8}$); **change recurring decimals into their corresponding fractions and vice versa**

N11 identify and work with fractions in ratio problems

N12 interpret fractions and percentages as operators

Measures and accuracy

What students need to learn:

N13 use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate

N14 estimate answers; check calculations using approximation and estimation, including answers obtained using technology

N15 round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures); use inequality notation to specify simple error intervals due to truncation or rounding

N16 apply and interpret limits of accuracy, **including upper and lower bounds**

2. Algebra

Notation, vocabulary and manipulation

What students need to learn:

A1 use and interpret algebraic manipulation, including:

- ab in place of $a \times b$
- $3y$ in place of $y + y + y$ and $3 \times y$
- a^2 in place of $a \times a$, a^3 in place of $a \times a \times a$, a^2b in place of $a \times a \times b$
- $\frac{a}{b}$ in place of $a \div b$
- coefficients written as fractions rather than as decimals
- brackets

A2 substitute numerical values into formulae and expressions, including scientific formulae

A3 understand and use the concepts and vocabulary of expressions, equations, formulae, identities, inequalities, terms and factors

A4 simplify and manipulate algebraic expressions (including those involving surds **and algebraic fractions**) by:

- collecting like terms
- multiplying a single term over a bracket
- taking out common factors
- expanding products of two **or more** binomials
- factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares; **factorising quadratic expressions of the form $ax^2 + bx + c$**
- simplifying expressions involving sums, products and powers, including the laws of indices

A5 understand and use standard mathematical formulae; rearrange formulae to change the subject

A6 know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments **and proofs**

A7 where appropriate, interpret simple expressions as functions with inputs and outputs**; interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function' (the use of formal function notation is expected)**

Graphs

What students need to learn:

A8 work with coordinates in all four quadrants

A9 plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form $y = mx + c$ to identify parallel **and perpendicular lines**; find the equation of the line through two given points or through one point with a given gradient

A10 identify and interpret gradients and intercepts of linear functions graphically and algebraically

A11 identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically **and turning points by completing the square**

A12 recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$, **exponential functions $y = k^x$ for positive values of k, and the trigonometric functions (with arguments in degrees) $y = \sin x$, $y = \cos x$ and $y = \tan x$ for angles of any size**

A13 **sketch translations and reflections of a given function**

A14 plot and interpret graphs (including reciprocal graphs **and exponential graphs**) and graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration

A15 **calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts (this does not include calculus)**

A16 **recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point**

Solving equations and inequalities

What students need to learn:

A17 solve linear equations in one unknown algebraically (including those with the unknown on both sides of the equation); find approximate solutions using a graph

A18 solve quadratic equations (**including those that require rearrangement**) algebraically by factorising, **by completing the square and by using the quadratic formula**; find approximate solutions using a graph

A19 solve two simultaneous equations in two variables (linear/linear **or linear/quadratic**) algebraically; find approximate solutions using a graph

A20 **find approximate solutions to equations numerically using iteration**

A21 translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution

A22 solve linear inequalities in one **or two** variable**(s)**, **and quadratic inequalities in one variable;** represent the solution set on a number line, **using set notation and on a graph**

Sequences

What students need to learn:

A23 generate terms of a sequence from either a term-to-term or a position-to-term rule

A24 recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r^n where n is an integer, and r is a rational number > 0 **or a surd**) **and other sequences**

A25 deduce expressions to calculate the nth term of linear **and quadratic** sequences

3. Ratio, proportion and rates of change

What students need to learn:

R1 change freely between related standard units (e.g. time, length, area, volume/capacity, mass) and compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts

R2 use scale factors, scale diagrams and maps

R3 express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1

R4 use ratio notation, including reduction to simplest form

R5 divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)

R6 express a multiplicative relationship between two quantities as a ratio or a fraction

R7 understand and use proportion as equality of ratios

R8 relate ratios to fractions and to linear functions

R9 define percentage as 'number of parts per hundred'; interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; express one quantity as a percentage of another; compare two quantities using percentages; work with percentages greater than 100%; solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics

R10 solve problems involving direct and inverse proportion, including graphical and algebraic representations

R11 use compound units such as speed, rates of pay, unit pricing, density and pressure

R12 compare lengths, areas and volumes using ratio notation; make links to similarity (including trigonometric ratios) and scale factors

R13 understand that X is inversely proportional to Y is equivalent to X is proportional to $\frac{1}{Y}$; **construct and** interpret equations that describe direct and inverse proportion

R14 interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion

R15 **interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of average and instantaneous rate of change (gradients of chords and tangents) in numerical, algebraic and graphical contexts (this does not include calculus)**

R16 set up, solve and interpret the answers in growth and decay problems, including compound interest **and work with general iterative processes**

4. Geometry and measures

Properties and constructions

What students need to learn:

G1 use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries; use the standard conventions for labelling and referring to the sides and angles of triangles; draw diagrams from written description

G2 use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line

G3 apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)

G4 derive and apply the properties and definitions of: special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles and other plane figures using appropriate language

G5 use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)

G6 apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs

G7 identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (including fractional **and negative** scale factors)

G8 **describe the changes and invariance achieved by combinations of rotations, reflections and translations**

G9 identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment

G10 **apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results**

G11 solve geometrical problems on coordinate axes

G12 identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres

G13 construct and interpret plans and elevations of 3D shapes

Mensuration and calculation

What students need to learn:

G14 use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc.)

G15 measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings

G16 know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids and other right prisms (including cylinders)

G17 know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2; calculate: perimeters of 2D shapes, including circles; areas of circles and composite shapes; surface area and volume of spheres, pyramids, cones and composite solids

G18 calculate arc lengths, angles and areas of sectors of circles

G19 apply the concepts of congruence and similarity, including the relationships between lengths, **areas and volumes** in similar figures

G20 know the formulae for: Pythagoras' theorem $a^2 + b^2 = c^2$, and the trigonometric ratios, $\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$, $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$ and $\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$; apply them to find angles and lengths in right-angled triangles **and, where possible, general triangles** in two **and three** dimensional figures

G21 know the exact values of $\sin\theta$ and $\cos\theta$ for $\theta = 0°, 30°, 45°, 60°$ and $90°$; know the exact value of $\tan\theta$ for $\theta = 0°, 30°, 45°$ and $60°$

G22 **know and apply the sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$, and cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$, to find unknown lengths and angles**

G23 **know and apply Area = $\frac{1}{2}ab\sin C$ to calculate the area, sides or angles of any triangle**

Vectors

What students need to learn:

G24 describe translations as 2D vectors

G25 apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; **use vectors to construct geometric arguments and proofs**

5. Probability

What students need to learn:

P1 record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees

P2 apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments

P3 relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale

P4 apply the property that the probabilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one

P5 understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size

P6 enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams and tree diagrams

P7 construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities

P8 calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions

P9 **calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams**

6. Statistics

What students need to learn:

S1 infer properties of populations or distributions from a sample, while knowing the limitations of sampling

S2 interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data and know their appropriate use

S3 **construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use**

S4 interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:

- appropriate graphical representation involving discrete, continuous and grouped data, **including box plots**
- appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers, **quartiles and inter-quartile range**)

S5 apply statistics to describe a population

S6 use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends while knowing the dangers of so doing

Assessment

Assessment summary

The Pearson Edexcel Level 1/Level 2 GCSE (9 to 1) in Mathematics is a tiered qualification. There are two tiers:

- Foundation tier - grades 1 to 5 available
- Higher tier grades – 4 to 9 available (grade 3 allowed).

The assessment for each tier of entry consists of three externally-examined papers, all three must be from the same tier of entry. Students must complete all three papers in the same assessment series.

Summary of table of assessment

Paper 1	***Paper code: 1MA1/1F or 1MA1/1H**
• Externally assessed • Availability: May/June and November** • First assessment: May/June 2017	**33.33% of the total GCSE**
Overview of content 1. Number 2. Algebra 3. Ratio, proportion and rates of change 4. Geometry and measures 5. Probability 6. Statistics	
Overview of assessment • Written examination papers with a range of question types • No calculator is allowed • 1 hour and 30 minutes (both Foundation and Higher tier papers) • 80 marks available	

The sample assessment materials can be found in the *Pearson Edexcel Level 1/ Level 2 GCSE (9–1) in Mathematics Sample Assessment Materials* document.

*See *Appendix 2: Codes* for a description of this code and all other codes relevant to this qualification.

**See the *November resits* section for restrictions on November entry.

Paper 2	***Paper code: 1MA1/2F or 1MA1/2H**
• Externally assessed • Availability: May/June and November** • First assessment: May/June 2017	**33.33% of the total GCSE**
Overview of content 1. Number 2. Algebra 3. Ratio, proportion and rates of change 4. Geometry and measures 5. Probability 6. Statistics	
Overview of assessment • Written examination papers with a range of question types • Calculator allowed • 1 hour and 30 minutes (both Foundation and Higher tier papers) • 80 marks available	

*See *Appendix 2: Codes* for a description of this code and all other codes relevant to this qualification.

**See the *November resits* section for restrictions on November entry.

Paper 3	***Paper code: 1MA1/3F or 1MA1/3H**
• Externally assessed • Availability: May/June and November** • First assessment: May/June 2017	**33.33% of the total GCSE**
Overview of content 1. Number 2. Algebra 3. Ratio, proportion and rates of change 4. Geometry and measures 5. Probability 6. Statistics	
Overview of assessment • Written examination papers with a range of question types • Calculator allowed • 1 hour and 30 minutes (both Foundation and Higher tier papers) • 80 marks available	

*See *Appendix 2: Codes* for a description of this code and all other codes relevant to this qualification.

**See the *November resits* section for restrictions on November entry.

Assessment Objectives and weightings

		% Foundation	% Higher
AO1	**Use and apply standard techniques** Students should be able to: • accurately recall facts, terminology and definitions • use and interpret notation correctly • accurately carry out routine procedures or set tasks requiring multi-step solutions.	50	40
AO2	**Reason, interpret and communicate mathematically** Students should be able to: • make deductions, inferences and draw conclusions from mathematical information • construct chains of reasoning to achieve a given result • interpret and communicate information accurately • present arguments and proofs • assess the validity of an argument and critically evaluate a given way of presenting information. Where problems require students to 'use and apply standard techniques' or to independently 'solve problems' a proportion of those marks should be attributed to the corresponding Assessment Objective.	25	30

		% Foundation	% Higher
AO3	**Solve problems within mathematics and in other contexts** Students should be able to: • translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes • make and use connections between different parts of mathematics • interpret results in the context of the given problem • evaluate methods used and results obtained • evaluate solutions to identify how they may have been affected by assumptions made. Where problems require students to 'use and apply standard techniques' or to 'reason, interpret and communicate mathematically' a proportion of those marks should be attributed to the corresponding Assessment Objective.	25	30
	Total	**100%**	**100%**

Breakdown of Assessment Objectives into strands and elements

The strands and elements shown below will be assessed in every examination series, the marks allocated to these strands and elements are shown in the mark schemes.

AO1 Use and apply standard techniques	
Strands	***Elements***
1 – Accurately recall facts, terminology and definitions	1 – accurately recall facts, terminology and definitions Should be no more than 10% of AO1
2 – Use and interpret notation correctly	2 – use and interpret notation correctly
3 – Accurately carry out routine procedures or set tasks requiring multi-step solutions	3a – accurately carry out routine procedures
	3b – accurately carry out set tasks requiring multi-step solutions
AO2 Reason, interpret and communicate mathematically	
Strands	***Elements***
1 – Make deductions, inferences and draw conclusions from mathematical information	1a – make deductions to draw conclusions from mathematical information
	1b – make inferences to draw conclusions from mathematical information
2 – Construct chains of reasoning to achieve a given result	*2 – construct chains of reasoning to achieve a given result*
3 – Interpret and communicate information accurately	3a – interpret information accurately
	3b – communicate information accurately
4 – Present arguments and proofs	4a – present arguments
	4b – present proofs **(higher tier only)**
5 – Assess the validity of an argument and critically evaluate a given way of presenting information	5a – assess the validity of an argument
	5b – critically evaluate a given way of presenting information

AO3 Solve problems within mathematics and in other contexts	
Strands	***Elements***
1 – Translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes	1a – translate problems in mathematical contexts into a process
	1b – translate problems in mathematical contexts into a series of processes
	1c – translate problems in non-mathematical contexts into a mathematical process
	1d – translate problems in non-mathematical contexts into a series of mathematical processes
2 – Make and use connections between different parts of mathematics	*2 – make and use connections between different parts of mathematics*
3 – Interpret results in the context of the given problem	*3 – interpret results in the context of the given problem*
4 – Evaluate methods used and results obtained	4a – evaluate methods used
	4b – evaluate results obtained
5 – Evaluate solutions to identify how they may have been affected by assumptions made	*5 – evaluate solutions to identify how they may have been affected by assumptions made*

Entry and assessment information

Student entry

Details of how to enter students for the examinations for this qualification can be found in our *UK Information Manual*. A copy is made available to all examinations officers and is available on our website at: www.edexcel.com/iwantto/Pages/uk-information-manual.aspx

Forbidden combinations and discount code

There are two tiers of entry available. Each student is permitted to take assessments in either the Foundation tier or Higher tier. All three papers must be from the same tier of entry and must be completed in the same assessment series.

Centres should be aware that students who enter for more than one GCSE or other Level 2 qualifications with the same discount code will have only the grade for their 'first entry' counted for the purpose of the School and College Performance Tables (please see *Appendix 2: Codes*). For further information about what constitutes 'first entry' and full details of how this policy is applied, please refer to the DfE website: www.education.gov.uk

Students should be advised that, if they take two GCSEs with the same discount code, schools and colleges to which they wish to progress are very likely to take the view that they have achieved only one of the two GCSEs. The same view may be taken if students take two GCSE or other Level 2 qualifications that have different discount codes but have significant overlap of content. Students or their advisers who have any doubts about their subject combinations should check with the institution to which they wish to progress before embarking on their programmes.

November resits

This qualification is available in both summer and November series. Entry to the November series is restricted. Students who take GCSE Mathematics in a November series must be at least 16 years of age on the preceding 31st August.

Please go to our website www.edexcel.com for further information.

Access arrangements, reasonable adjustments and special consideration

Access arrangements

Access arrangements are agreed before an assessment. They allow students with special educational needs, disabilities or temporary injuries to:

- access the assessment
- show what they know and can do without changing the demands of the assessment.

The intention behind an access arrangement is to meet the particular needs of an individual disabled student without affecting the integrity of the assessment. Access arrangements are the principal way in which awarding bodies comply with the duty under the Equality Act 2010 to make 'reasonable adjustments'.

Access arrangements should always be processed at the start of the course. Students will then know what is available and have the access arrangement(s) in place for assessment.

Reasonable adjustments

The Equality Act 2010 requires an awarding organisation to make reasonable adjustments where a person with a disability would be at a substantial disadvantage in undertaking an assessment. The awarding organisation is required to take reasonable steps to overcome that disadvantage.

A reasonable adjustment for a particular person may be unique to that individual and therefore might not be in the list of available access arrangements.

Whether an adjustment will be considered reasonable will depend on a number of factors, which will include:

- the needs of the student with the disability
- the effectiveness of the adjustment
- the cost of the adjustment; and
- the likely impact of the adjustment on the student with the disability and other students.

An adjustment will not be approved if it involves unreasonable costs to the awarding organisation, timeframes or affects the security or integrity of the assessment. This is because the adjustment is not 'reasonable'.

Special consideration

Special consideration is a post-examination adjustment to a student's mark or grade to reflect temporary injury, illness or other indisposition at the time of the examination/assessment, which has had, or is reasonably likely to have had, a material effect on a candidate's ability to take an assessment or demonstrate his or her level of attainment in an assessment.

Further information

Please see our website for further information about how to apply for access arrangements and special consideration.

For further information about access arrangements, reasonable adjustments and special consideration, please refer to the JCQ website: www.jcq.org.uk.

Equality Act 2010 and Pearson equality policy

Equality and fairness are central to our work. Our equality policy requires all students to have equal opportunity to access our qualifications and assessments, and our qualifications to be awarded in a way that is fair to every student.

We are committed to making sure that:

- students with a protected characteristic (as defined by the Equality Act 2010) are not, when they are undertaking one of our qualifications, disadvantaged in comparison to students who do not share that characteristic
- all students achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

You can find details on how to make adjustments for students with protected characteristics in the policy document *Access Arrangements, Reasonable Adjustments and Special Considerations*, which is on our website, www.edexcel.com/Policies.

Awarding and reporting

This qualification will be graded, awarded and certificated to comply with the requirements of the current GCSE and GCE Code of Practice, published by the Office of Qualifications and Examinations Regulation (Ofqual).

The GCSE (9 to 1) qualification will be graded and certificated on a nine-grade scale from 9 to 1 using the total subject mark where 9 is the highest grade. Individual components are not graded. For Foundation tier grades 1 – 5 are available, and for Higher tier grades 4 – 9 are available (grade 3 allowed).

The first certification opportunity for the Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Mathematics will be in 2017.

Students whose level of achievement is below the minimum judged by Pearson to be of sufficient standard to be recorded on a certificate will receive an unclassified U result.

Language of assessment

Assessment of this qualification will be available in English. All student work must be in English.

Grade descriptions

The grade descriptions for this qualification are published by Ofqual and will be available on its website.

Other information

Student recruitment

Pearson follows the JCQ policy concerning recruitment to our qualifications in that:

- they must be available to anyone who is capable of reaching the required standard
- they must be free from barriers that restrict access and progression
- equal opportunities exist for all students.

Prior learning

The qualification builds on the content, knowledge and skills developed in the *Key Stage 3 Programme of Study for Mathematics* (published by the Department for Education in September 2013).

Progression

Students can progress from this qualification to Level 3 qualifications in numerate disciplines, such as:

- Core Mathematics
- GCE Mathematics and GCE Further Mathematics
- GCEs in the sciences
- GCE Geography
- GCE Psychology
- GCE Economics
- other qualifications that require mathematical skills, knowledge and understanding.

There is a clear progression path from Foundation tier to Higher tier within this qualification.

This qualification also supports further training and employment where mathematical skills are required.

Progression from GCSE

This qualification prepares students for progression to further study of mathematics at AS and A level, and also to the study of Core Mathematics. These Level 3 qualifications prepare students for a variety of further progression routes. Students should seek advice about which of these qualifications best prepares them for their intended progression routes.

GCSE Mathematics is a requirement for progression to a wide range of courses at Level 3. Students are expected to continue with their study of GCSE Mathematics after the age of 16 if they have not achieved the qualification at Key Stage 4.

Appendices

Appendix 1: Transferable skills

The need for transferable skills

In recent years, higher education institutions and employers have consistently flagged the need for students to develop a range of transferable skills to enable them to respond with confidence to the demands of undergraduate study and the world of work.

The Organisation for Economic Co-operation and Development (OECD) defines skills, or competencies, as 'the bundle of knowledge, attributes and capacities that can be learned and that enable individuals to successfully and consistently perform an activity or task and can be built upon and extended through learning.'[1]

To support the design of our qualifications, the Pearson Research Team selected and evaluated seven global 21st-century skills frameworks. Following on from this process, we identified the National Research Council's (NRC) framework as the most evidence-based and robust skills framework. We adapted the framework slightly to include the Program for International Student Assessment (PISA) ICT Literacy and Collaborative Problem Solving (CPS) Skills.

The adapted National Research Council's framework of skills involves:[2]

Cognitive skills

- **Non-routine problem solving** – expert thinking, metacognition, creativity.
- **Systems thinking** – decision making and reasoning.
- **Critical thinking** – definitions of critical thinking are broad and usually involve general cognitive skills such as analysing, synthesising and reasoning skills.
- **ICT literacy** - access, manage, integrate, evaluate, construct and communicate[3].

Interpersonal skills

- **Communication** – active listening, oral communication, written communication, assertive communication and non-verbal communication.
- **Relationship-building skills** – teamwork, trust, intercultural sensitivity, service orientation, self-presentation, social influence, conflict resolution and negotiation.
- **Collaborative problem solving** – establishing and maintaining shared understanding, taking appropriate action, establishing and maintaining team organisation.

[1] OECD (2012), Better Skills, Better Jobs, Better Lives (2012): http://skills.oecd.org/documents/OECDSkillsStrategyFINALENG.pdf

[2] Koenig, J. A. (2011) Assessing 21st Century Skills: Summary of a Workshop, National Research Council

[3] PISA (2011) The PISA Framework for Assessment of ICT Literacy, PISA

Intrapersonal skills

- **Adaptability** – ability and willingness to cope with the uncertain, handling work stress, adapting to different personalities, communication styles and cultures, and physical adaptability to various indoor and outdoor work environments.
- **Self-management and self-development** – ability to work remotely in virtual teams, work autonomously, be self-motivating and self-monitoring, willing and able to acquire new information and skills related to work.

Transferable skills enable young people to face the demands of further and higher education, as well as the demands of the workplace, and are important in the teaching and learning of this qualification. We will provide teaching and learning materials, developed with stakeholders, to support our qualifications.

Appendix 2: Codes

Type of code	Use of code	Code number
Discount codes	Every qualification is assigned to a discount code indicating the subject area to which it belongs. This code may change. Please refer to our website (www.edexcel.com) for details of any changes.	RB1
National Qualifications Framework (NQF) codes	Each qualification title is allocated an Ofqual National Qualifications Framework (NQF) code. The NQF code is known as a Qualification Number (QN). This is the code that features in the DfE Section 96 and on the LARA as being eligible for 16–18 and 19+ funding, and is to be used for all qualification funding purposes. The QN is the number that will appear on the student's final certification documentation.	The QN for the qualification in this publication is: GCSE (9 to 1) – 601/4700/3
Subject codes	The subject code is used by centres to enter students for a qualification. Centres will need to use the entry codes only when claiming students' qualifications.	GCSE (9–1) – 1MA1
Paper/component code	These codes are provided for reference purposes. Students do not need to be entered for individual papers/components.	Paper 1: 1MA1/1F or 1MA1/1H Paper 2: 1MA1/2F or 1MA1/2H Paper 3: 1MA1/3F or 1MA1/3H

Appendix 3: Mathematical formulae

The following formulae will be provided for students within the relevant examination questions.

Perimeter, area, surface area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

Curved surface area of a cone $= \pi rl$

Surface area of a sphere $= 4\pi r^2$

Volume of a sphere $= \frac{4}{3}\pi r^3$

Volume of a cone $= \frac{1}{3}\pi r^2 h$

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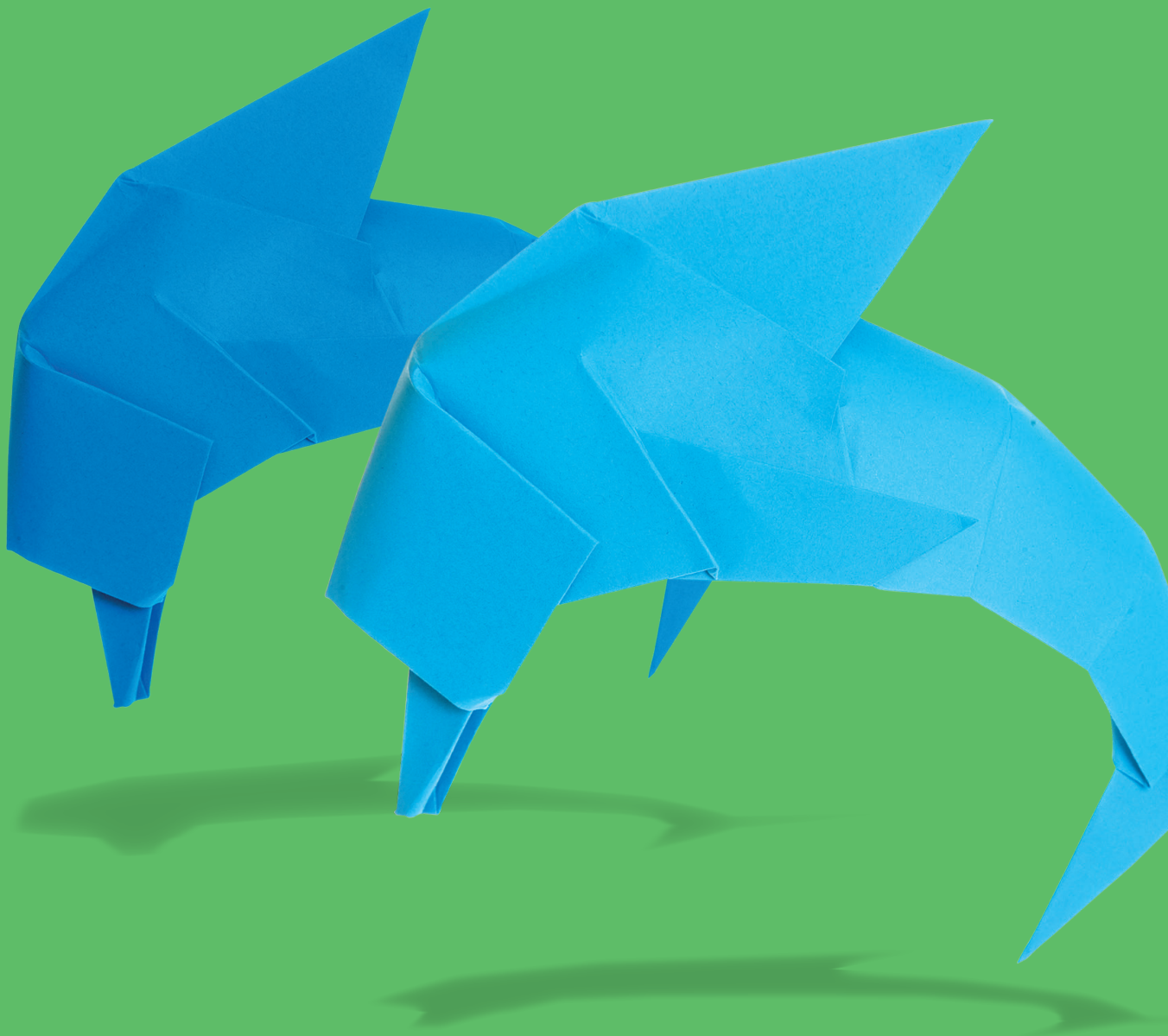
GCSE (9-1) Mathematics



Sample Assessment Materials

Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Mathematics (1MA1)

First teaching from September 2015

First certification from June 2017

Issue 2

ALWAYS LEARNING

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Edexcel, BTEC and LCCI qualifications

Edexcel, BTEC and LCCI qualifications are awarded by Pearson, the UK's largest awarding body offering academic and vocational qualifications that are globally recognised and benchmarked. For further information, please visit our qualification websites at www.edexcel.com, www.btec.co.uk or www.lcci.org.uk. Alternatively, you can get in touch with us using the details on our contact us page at qualifications.pearson.com/contactus

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All information in this document is correct at time of publication.

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Contents

Introduction

The Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Mathematics is designed for use in schools and colleges. It is part of a suite of GCSE qualifications offered by Pearson.

These sample assessment materials have been developed to support this qualification and will be used as the benchmark to develop the assessment students will take.

General marking guidance

These notes offer general guidance, but the specific notes for examiners appertaining to individual questions take precedence.

1 All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.

Where some judgement is required, mark schemes will provide the principles by which marks will be awarded; exemplification/indicative content will not be exhaustive.

2 All the marks on the mark scheme are designed to be awarded; mark schemes should be applied positively. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme. If there is a wrong answer (or no answer) indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

Questions where working is not required: In general, the correct answer should be given full marks.

Questions that specifically require working: In general, candidates who do not show working on this type of question will get no marks – full details will be given in the mark scheme for each individual question.

3 Crossed out work

This should be marked **unless** the candidate has replaced it with an alternative response.

4 Choice of method

If there is a choice of methods shown, mark the method that leads to the answer given on the answer line.

If no answer appears on the answer line, mark both methods **then award the lower number of marks.**

5 Incorrect method

If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review for your Team Leader to check.

6 Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working as you can check the answer, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

7 Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question or its context. (eg. an incorrectly cancelled fraction when the unsimplified fraction would gain full marks).

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect (eg. incorrect algebraic simplification).

8 Probability

Probability answers must be given as a fraction, percentage or decimal. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

9 Linear equations

Unless indicated otherwise in the mark scheme, full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously identified in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded (embedded answers).

10 Range of answers

Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and all numbers within the range.

Guidance on the use of abbreviations within this mark scheme
M method mark awarded for a correct method or partial method
P process mark awarded for a correct process as part of a problem solving question
A accuracy mark (awarded after a correct method or process; if no method or process is seen then full marks for the question are implied but see individual mark schemes for more details)
C communication mark
B unconditional accuracy mark (no method needed)
oe or equivalent
cao correct answer only
ft follow through (when appropriate as per mark scheme)
sc special case
dep dependent (on a previous mark)
indep independent
awrt answer which rounds to
isw ignore subsequent working

Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number	Candidate Number

Mathematics

Paper 1 (Non-Calculator)

Foundation Tier

Sample Assessment Materials – Issue 2	Paper Reference
Time: 1 hour 30 minutes	**1MA1/1F**

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may not be used.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out**.

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

S48571A

6/4/7/7/7/4/6/6/6/6/

S 4 8 5 7 1 A 0 1 2 0

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Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Write the following numbers in order of size.
Start with the smallest number.

0.61 0.1 0.16 0.106

.....

(Total for Question 1 is 1 mark)

2 Write 0.037 as a fraction.

.....

(Total for Question 2 is 1 mark)

3 Write down the 20th odd number.

.....

(Total for Question 3 is 1 mark)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

4 Write down all the factors of 20

.....

(Total for Question 4 is 2 marks)

5 Tanya needs to buy chocolate bars for all the children in Year 7
Each of the 130 children get one chocolate bar.

There are 8 chocolate bars in each packet.

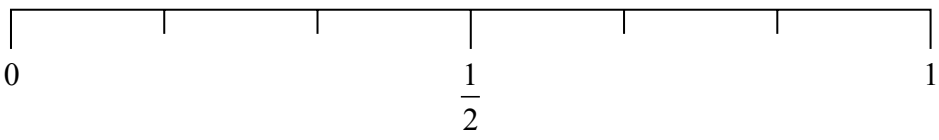
Work out the least number of packets of chocolate bars that Tanya needs to buy.

.....

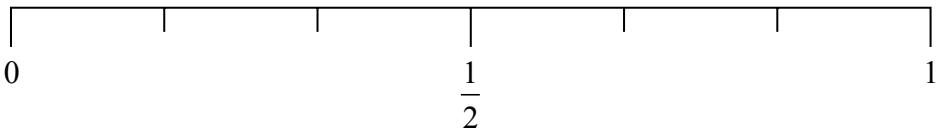
(Total for Question 5 is 3 marks)

6 Greg rolls a fair ordinary dice once.

(i) On the probability scale, mark with a cross (×) the probability that the dice will land on an odd number.



(ii) On the probability scale, mark with a cross (×) the probability that the dice will land on a number less than 5



(Total for Question 6 is 2 marks)

7 One day Sally earned £60
She worked for 8 hours.

Work out Sally's hourly rate of pay.

£.....

(Total for Question 7 is 2 marks)

8 Work out 15% of 80

.....

(Total for Question 8 is 2 marks)

9 There are 3 red beads and 1 blue bead in a jar.
A bead is taken at random from the jar.

What is the probability that the bead is blue?

.....

(Total for Question 9 is 1 mark)

10 There are only black pens and green pens in a box.
The ratio of the number of black pens in the box to the number of green pens in the box is 2 : 5

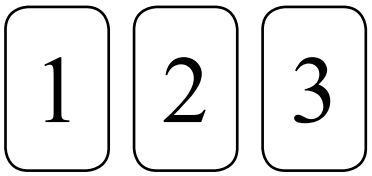
What fraction of the pens are black?

.....

(Total for Question 10 is 1 mark)

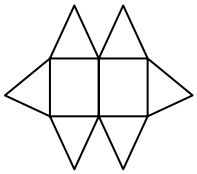
11 Sally has three tiles.
Each tile has a different number on it.
Sally puts the three tiles down to make a number.
Each number is made with all three tiles.

How many different numbers can Sally make?

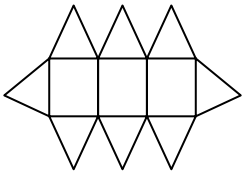


(Total for Question 11 is 2 marks)

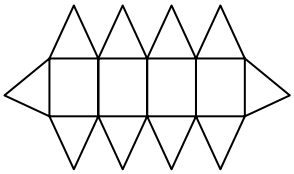
12 Here are the first three patterns in a sequence.
The patterns are made from triangles and rectangles.



pattern number 1



pattern number 2



pattern number 3

(a) How many triangles are there in pattern number 7?

.....

(2)

Charlie says

"There are 4 rectangles in pattern number 3 so there will be 8 rectangles in pattern number 6"

(b) Is Charlie right?
Give a reason for your answer.

.....

.....

(1)

(Total for Question 12 is 3 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

13 Paul organised an event for a charity.

Each ticket for the event cost £19.95
Paul sold 395 tickets.

Paul paid costs of £6000
He gave all money left to the charity.

(a) Work out an estimate for the amount of money Paul gave to the charity.

£.....

(3)

(b) Is your answer to (a) an underestimate or an overestimate?
Give a reason for your answer.

.....

.....

(1)

(Total for Question 13 is 4 marks)

14 The table shows information about the numbers of fruit trees in an orchard.

Apple tree	Pear tree	Plum tree
45	20	25

(a) The pictogram shows this information.

Complete the key for the pictogram.

Apple tree	△ △ △ △ △ △ △ △ △
Pear tree	△ △ △ △
Plum tree	△ △ △ △ △

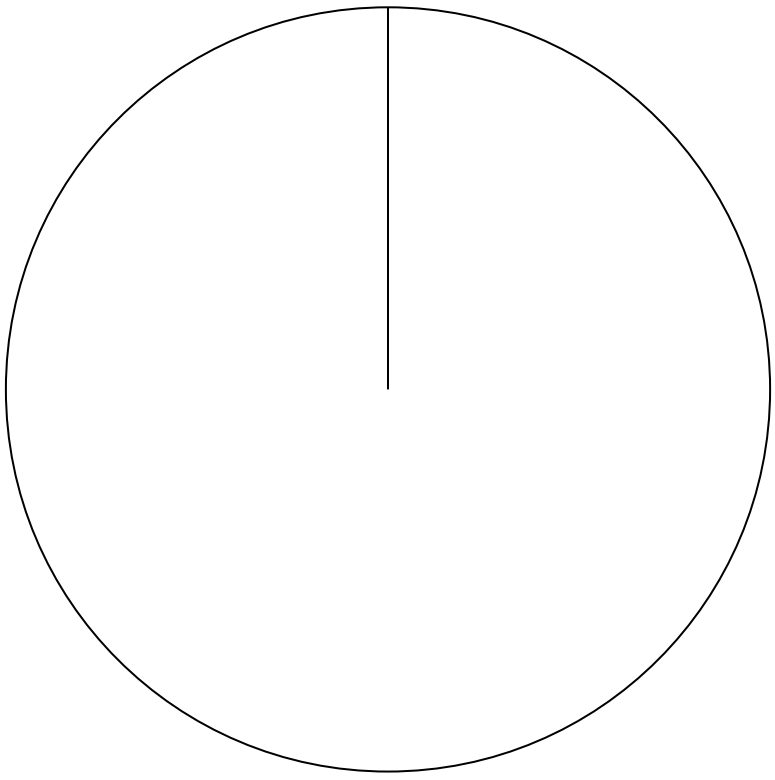
Key: △ represents ..... trees

(1)

(b) There are 90 fruit trees in the orchard.

Apple tree	Pear tree	Plum tree
45	20	25

Draw an accurate pie chart for this information.



(3)

(Total for Question 14 is 4 marks)

15 Carpet tiles are going to be used to cover a floor.

The floor is a 1200 mm by 1000 mm rectangle.
Each carpet tile is a 40 cm by 30 cm rectangle.

Exactly 10 carpet tiles can be used to cover the floor completely.

Show in a labelled sketch how this can be done.

(Total for Question 15 is 3 marks)

16 Sam buys 20 boxes of oranges.
There are 25 oranges in each box.

Each boxes of oranges costs £7

Sam sells $\frac{2}{5}$ of the oranges he bought.

He sells each of these oranges for 40p.

He then sells each of the remaining oranges at 3 oranges for 50p.

Did Sam make a profit or did Sam make a loss?
You must show working to justify your answer.

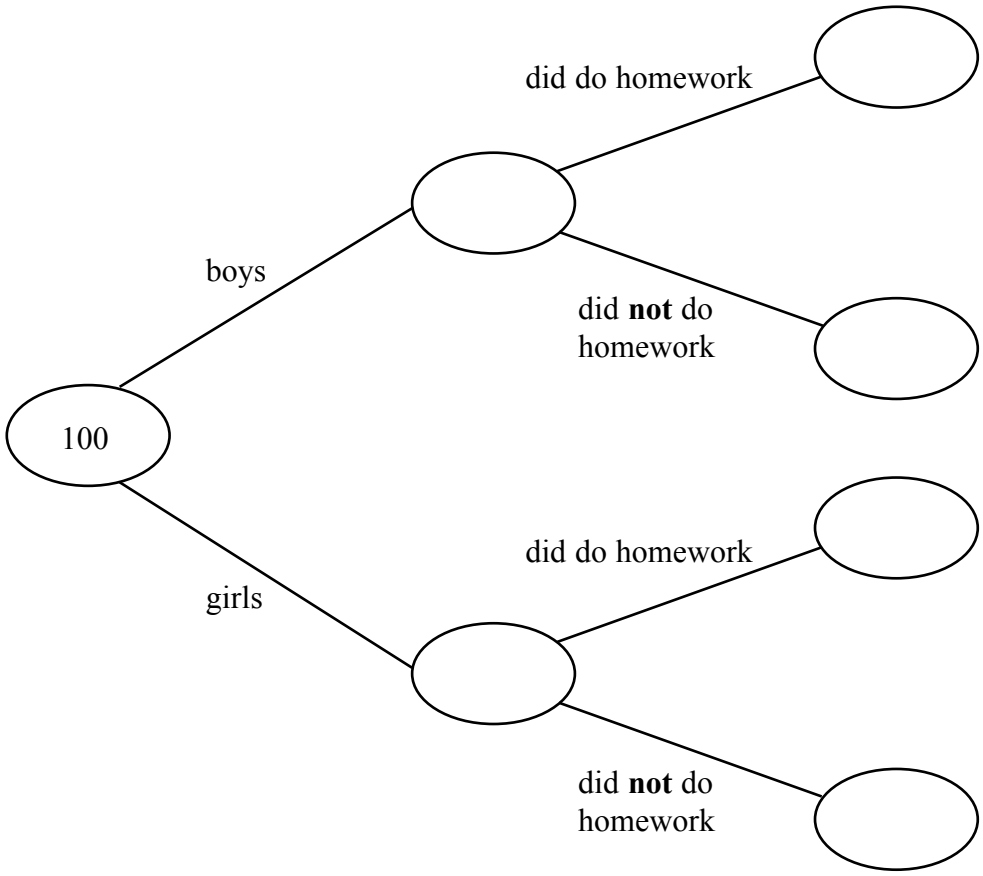
(Total for Question 16 is 5 marks)

17 100 students had some homework.

42 of these students are boys.
8 of the 100 students did **not** do their homework.
53 of the girls did do their homework.

(a) Use this information to complete the frequency tree.

(3)



One of the girls is chosen at random.

(b) Work out the probability that this girl did **not** do her homework.

.....

(2)

(Total for Question 17 is 5 marks)

18 (a) Work out $\frac{2}{7} + \frac{1}{5}$

.....

(2)

(b) Work out $1\frac{2}{3} \div \frac{3}{4}$

.....

(2)

(Total for Question 18 is 4 marks)

19 Solve $4x + 5 = x + 26$

$x =$ .....

(Total for Question 19 is 2 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

20 In a sale, normal prices are reduced by 20%.
The normal price of a coat is reduced by £15

Work out the normal price of the coat.

£.....

(Total for Question 20 is 2 marks)

21 Work out 6.34 × 5.2

.....

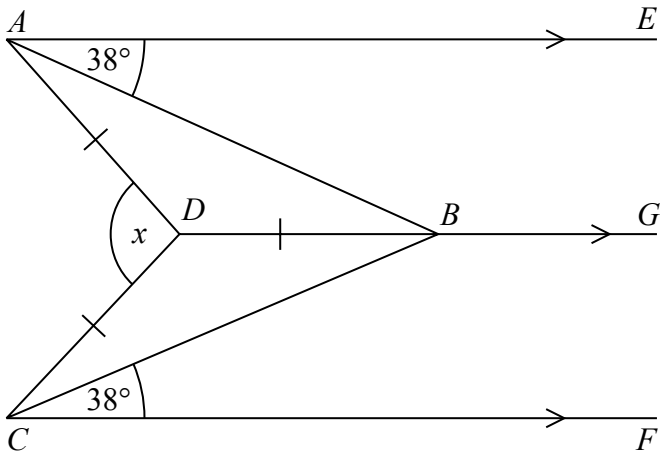
(Total for Question 21 is 3 marks)

22 Expand and simplify $(m + 7)(m + 3)$

.....

(Total for Question 22 is 2 marks)

23



AE, *DBG* and *CF* are parallel.
DA = *DB* = *DC*.
Angle *EAB* = angle *BCF* = 38°

Work out the size of the angle marked *x*.
You must show your working.

.....°

(Total for Question 23 is 3 marks)

24 Gary drove from London to Sheffield.
It took him 3 hours at an average speed of 80 km/h.

Lyn drove from London to Sheffield.
She took 5 hours.

Assuming that Lyn
drove along the same roads as Gary
and did not take a break,

(a) work out Lyn's average speed from London to Sheffield.

.....km/h

(3)

(b) If Lyn did **not** drive along the same roads as Gary, explain how this could affect your answer to part (a).

.....

.....

(1)

(Total for Question 24 is 4 marks)

25 In a company, the ratio of the number of men to the number of women is 3 : 2

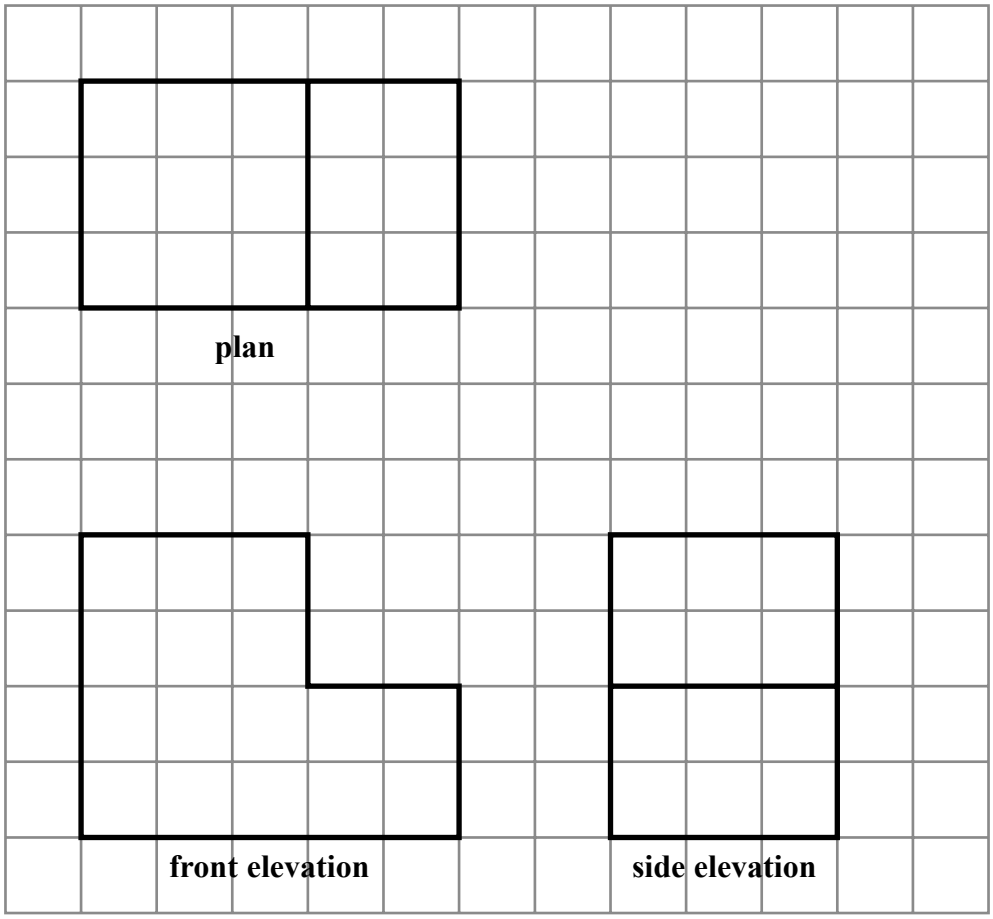
40% of the men are under the age of 25
10% of the women are under the age of 25

What percentage of all the people in the company are under the age of 25?

.....%

(Total for Question 25 is 4 marks)

26 The plan, front elevation and side elevation of a solid prism are drawn on a centimetre grid.



In the space below, draw a sketch of the solid prism.
Write the dimensions of the prism on your sketch.

(Total for Question 26 is 2 marks)

27 There are 1200 students at a school.

Kate is helping to organise a party.
She is going to order pizza.

Kate takes a sample of 60 of the students at the school.
She asks each student to tell her **one** type of pizza they want.

The table shows information about her results.

Pizza	Number of students
ham	20
salami	15
vegetarian	8
margarita	17

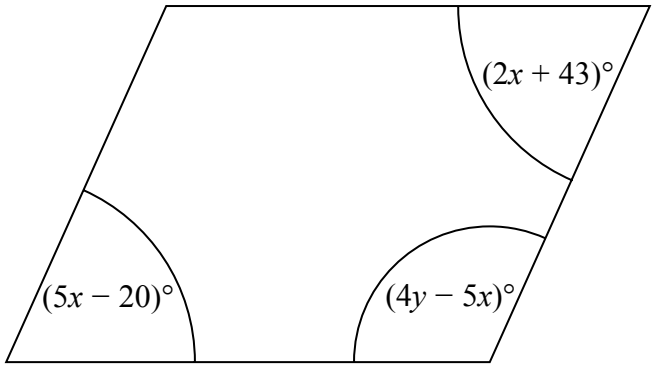
Work out how much ham pizza Kate should order.
Write down any assumption you make **and** explain how this could affect your answer.

.....

.....

(Total for Question 27 is 3 marks)

28 Here is a parallelogram.



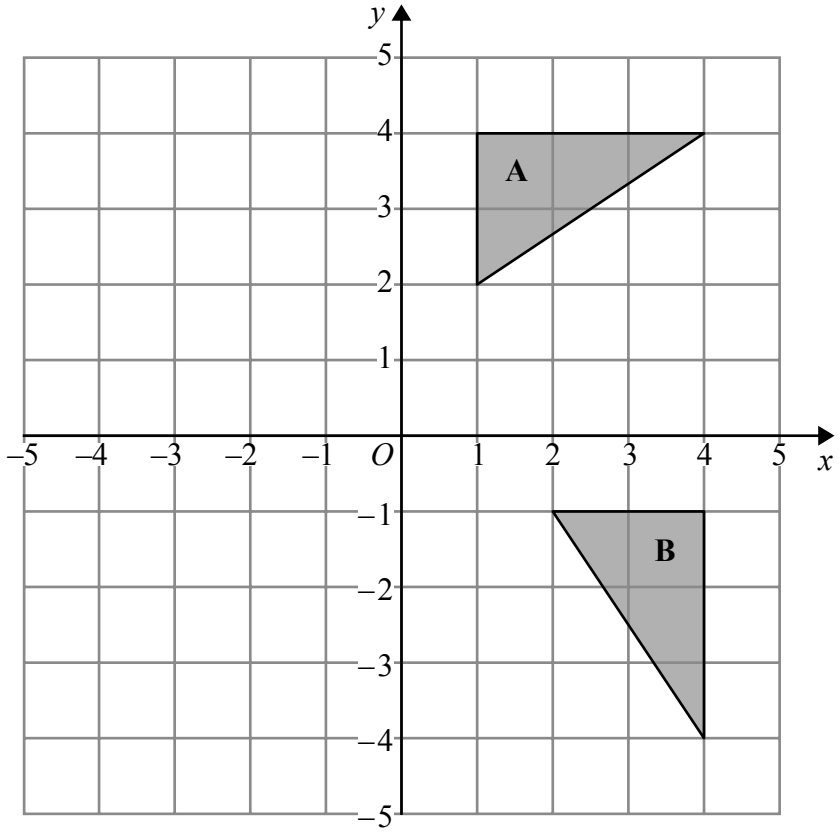
Work out the value of x and the value of y.

$x =$ .....

$y =$ .....

(Total for Question 28 is 5 marks)

29



Describe fully the single transformation that maps triangle **A** onto triangle **B**.

.....

.....

(Total for Question 29 is 2 marks)

30 $\mathbf{a} = \begin{pmatrix} 3 \\ -7 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$

Work out $\mathbf{b} - 2\mathbf{a}$ as a column vector.

.....

(Total for Question 30 is 2 marks)

TOTAL FOR PAPER IS 80 MARKS

Paper 1MA1: 1F			
Question	**Working**	**Answer**	**Notes**
1		0.1,0.106,0.16,0.61	B1
2		$\frac{37}{1000}$	B1
3		39	B1
4		1, 2, 4, 5, 10, 20	M1 for at least 3 factors A1 for all factors with no additions
5		17	P1 start to process information eg. 130 ÷ 8 **or** repeated subtraction from 130 **or** repeated addition A1 16.25 **or** 16 remainder 2 **or** 128 **or** 136 C1 allow ft - interprets answer to round up to integer value
6 (i)		× at $\frac{1}{2}$	B1
(ii)		× at $\frac{4}{6}$	B1

Paper 1MA1: 1F			
Question	**Working**	**Answer**	**Notes**
7		7.50	M1 60 ÷ 8 A1 accept 7.5
8		12	M1 M1 for 0.15 × 80 oe **or** 8 + 4 A1 cao
9		$\frac{1}{4}$	B1 $\frac{1}{4}$ oe
10		$\frac{2}{7}$	B1
11		6	M1 for starting to list combinations A1 cao
12 (a)		18	M1 Evidence of interpretation of pattern, eg. further diagrams drawn or numerical sequence for numbers of triangles 6, 8, 10 etc A1
(b)		No with reason	C1 No with reason eg. No , pattern number 6 will have 7 squares; always one more square than pattern number

Paper 1MA1: 1F			
Question	**Working**	**Answer**	**Notes**
13 (a)		2000	P1 Evidence of estimate eg. 400 or 20 used in calculation P1 complete process to solve problem A1
(b)		Overestimate with reason	C1 ft from (a) eg. overestimate as two numbers rounded up
14 (a)		5	B1
(b)		Correct pie chart with labels	C1 For apples shown as 'half' ie 180^o on pie chart C1 All angles calculated correctly (Angles of 180^o, 80^o, 100^o) **or** pie chart with correct angles C1 Fully correct pie chart with labels of apple, pear and plum
15		Correct diagram with layout and lengths	M1 for changing to consistent units eg. 1000 ÷ 10 or 40 × 10 M1 for interpreting information and a process to fit tiles in floor area eg. may be seen in a sketch or a calculation C1 for a diagram to communicate a correct layout with lengths clearly identified
16		loss (supported by correct figures)	P1 process to find total spent eg. 20 × 7 (=140) P1 complete process to find profit from full price oranges eg. $\frac{2}{5}\times 25\times 20\times 40(=8000)$ P1 complete process to find profit from reduced price oranges eg. $50\times\left(\frac{3}{5}\times 25\times 20\right)\div 3(=5000)$ P1 complete process to find total income with consistent units A1 loss with £10 **or** −£10 **or** £130 **and** £140

Paper 1MA1: 1F			
Question	**Working**	**Answer**	**Notes**
17 (a)		42, 58 39, 3, 53, 5	C1 starts to interpret information eg. one correct frequency C1 continue to interpret information C1 communicates all information correctly
(b)		$\frac{5}{58}$	M1 ft for $\frac{a}{58}$ with $a < 58$ **or** $\frac{5}{b}$ with $b > 5$ A1 ft from (a)
18 (a)		$\frac{17}{35}$	M1 for common denominators with at least one numerator correct A1
(b)		$\frac{20}{9}$	M1 for $\frac{5}{3} \times \frac{4}{3}$ **or** $\frac{20}{12} \div \frac{9}{12}$ A1
19		7	M1 Correct method to isolate terms in x A1
20		75	P1 for start to process eg. linking 20% with 15 or 100 ÷ 5 (=20) A1

Paper 1MA1: 1F			
Question	**Working**	**Answer**	**Notes**
21		32.968	M1 for correct method (condone one error) A1 for digits 32968 A1 ft (dep M1) for correct placement of decimal pt
22		$m^2 + 10m + 21$	M1 for at least 3 terms out of a maximum of 4 correct from expansion A1
23		152	M1 Start to method $ABD = 38^o$ **and** BAD or DBC or $DCB = 38^o$ M1 ADB or $BDC = 180 - 2 \times 38$ (=104) A1 for 152 with working
24 (a)		48	P1 start to process eg. 3×80 (=240) P1 '240' ÷ 5 A1
(b)			C1 eg. she may drive a different distance and therefore her average speed could be different

Paper 1MA1: 1F			
Question	**Working**	**Answer**	**Notes**
25		28	P1 Process to start to solve problem eg. $\frac{3}{5}\times 40$ **or** divide any number in the ratio 3:2 P1 Second step in process to solve problem eg. $\frac{2}{5}\times 10$ or find number of males/females under 25 for candidate's chosen number P1 for complete process A1
26		Correct sketch	C1 interprets diagram eg. draw a solid shape with at least two correct dimensions C1 draws correct prism with all necessary dimensions.
27		400	P1 Start to process eg. 1200 ÷ 60 A1 400 oe (accept number of whole pizzas eg. 400÷4 = 100 with 4 people per pizza) C1 Eg. Assumption that sample is representative of population – it may not be all 1200 people are going to the party – need less pizza if they don't, assume 4 people per pizza – if different may need more/fewer pizzas

Paper 1MA1: 1F			
Question	**Working**	**Answer**	**Notes**
28		$x = 21,\ y = 50$	P1 process to start solving problem eg. form an appropriate equation P1 complete process to isolate terms in x A1 for $x = 21$ P1 complete process to find second variable A1 $y = 50$
29		Rotation of 90^o clockwise about (0,0)	M1 For two of 'rotation' , (0,0), 90^o clockwise oe A1 Correct transformation
30		$\begin{pmatrix} -2 \\ 16 \end{pmatrix}$	C1 For $\begin{pmatrix} 4 \\ 2 \end{pmatrix} - 2\begin{pmatrix} 3 \\ -7 \end{pmatrix}$ C1

Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number	Candidate Number

Mathematics

Paper 2 (Calculator)

Foundation Tier

Sample Assessment Materials – Issue 2	Paper Reference
Time: 1 hour 30 minutes	**1MA1/2F**

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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6/4/7/7/4/6/6/6/6/

S 4 8 5 7 3 A 0 1 2 0

PEARSON

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Write down the value of the 3 in the number 4376

.....

(Total for Question 1 is 1 mark)

2 (a) Write $\frac{7}{16}$ as a decimal.

.....

(Total for Question 2 is 1 mark)

3 Here is a list of numbers

4 7 9 25 27 31 64

From the numbers in the list, write down a cube number.

.....

(Total for Question 3 is 1 mark)

4 Find the value of $(2.8 - 0.45)^2 + \sqrt[3]{5.832}$

.....

(Total for Question 4 is 2 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

5 There are some boys and girls in a classroom.

The probability of picking at random a boy is $\frac{1}{3}$

What is the probability of picking a girl?

.....

(Total for Question 5 is 1 mark)

6 Jan writes down

one multiple of 9
and two different factors of 40

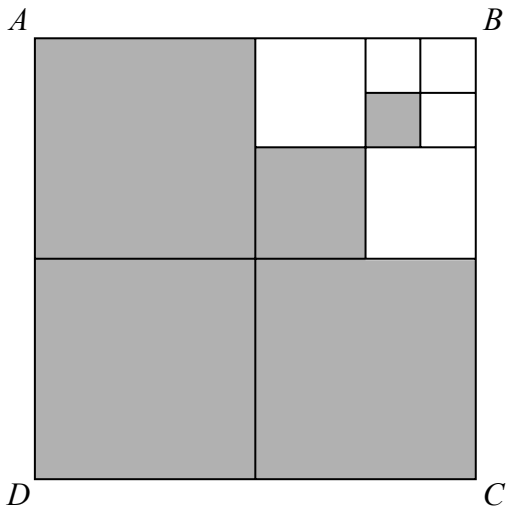
Jan adds together her three numbers.
Her answer is greater than 20 but less than 30

Find three numbers that Jan could have written down.

.....

(Total for Question 6 is 3 marks)

7 *ABCD* is a square.
This diagram is drawn accurately.



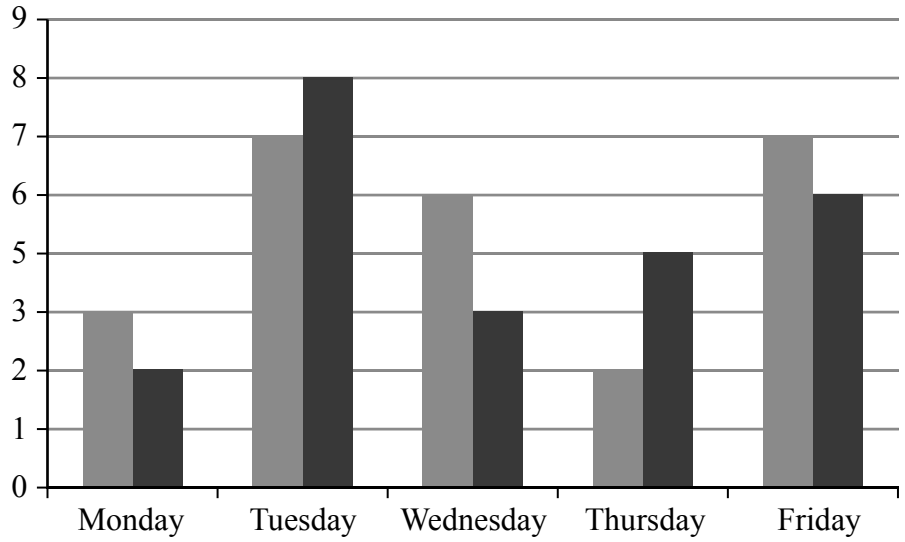
What fraction of the square *ABCD* is shaded?

.....

(Total for Question 7 is 2 marks)

8 Sam and Max work in a shop from Monday to Friday.

Sam draws a graph to show the number of TVs they each sell.



Write down **three** things that are wrong with this graph.

1 .....

.....

2 .....

.....

3 .....

.....

(Total for Question 8 is 3 marks)

9 Here is a list of numbers

12 19 12 15 11 15 12 13 17

Find the median.

.....

(Total for Question 9 is 2 marks)

10 (a) Rob buys p packets of plain crisps and c packets of cheese crisps.

Write down an expression for the total number of packets of crisps Rob buys.

.....

(1)

(b) Solve $3x - 5 = 9$

$x =$ .....

(2)

(Total for Question 10 is 3 marks)

11 Adam says,

"When you multiply an even number by an odd number
the answer is always an odd number."

(a) Write down an example to show Adam is wrong.

.....

(1)

Betty says,

"When you multiply two prime numbers together
the answer is always an odd number."

(b) Betty is wrong.
Explain why.

.....

.....

(2)

(Total for Question 11 is 3 marks)

DO NOT WRITE IN THIS AREA

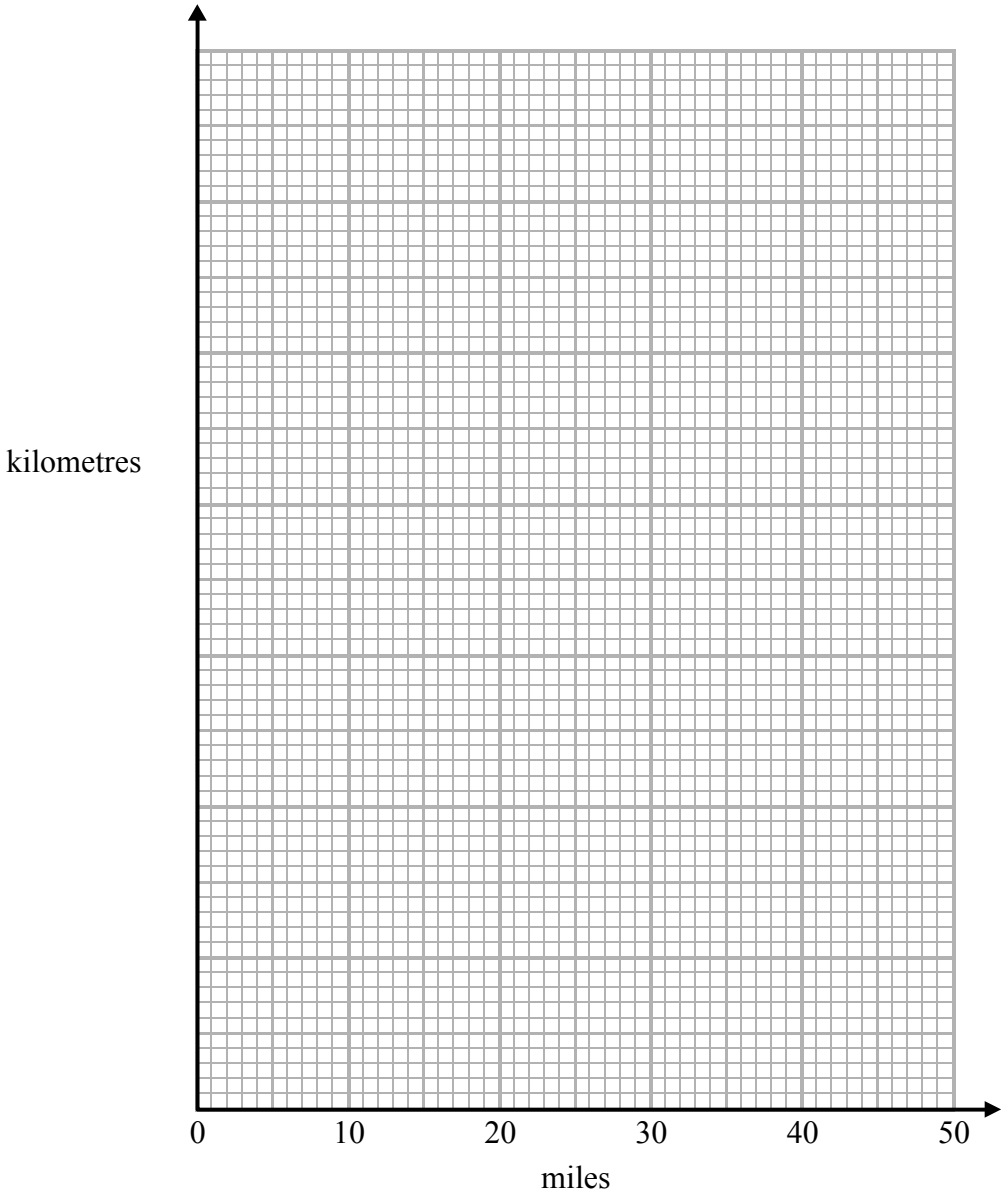
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

12 You can use the information in the table to convert between kilometres and miles.

miles	0	5	20	40
kilometres	0	8	32	64

(a) Use this information to draw a conversion graph.



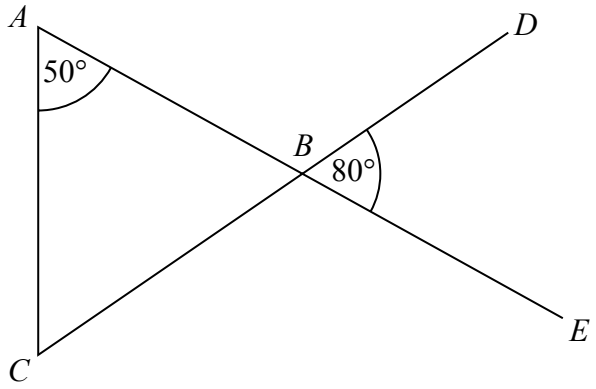
(3)

(b) Which is further, 20 kilometres or 15 miles?
You must show how you got your answer.

(2)

(Total for Question 12 is 5 marks)

13

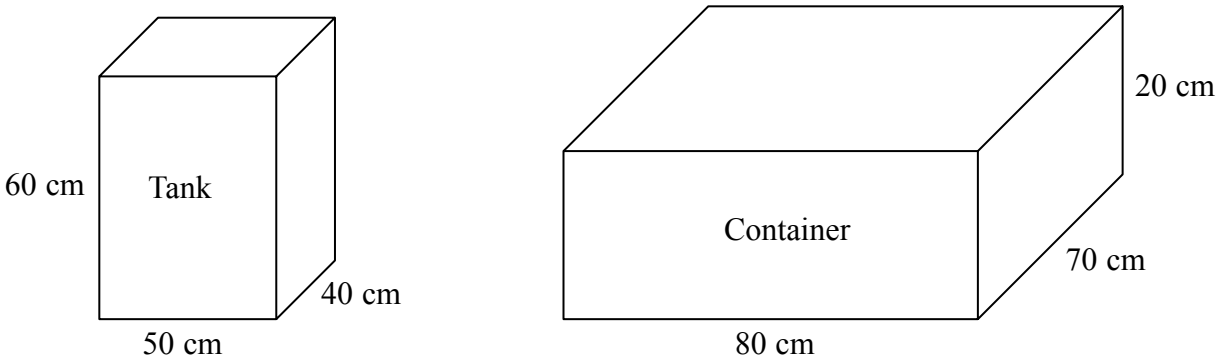


ABE and *CBD* are straight lines.

Show that triangle *ABC* is an isosceles triangle.
Give a reason for each stage of your working.

(Total for Question 13 is 4 marks)

14 The diagram shows a tank in the shape of a cuboid.
It also shows a container in the shape of a cuboid.



The tank is full of oil.
The container is empty.

35% of the oil from the tank is spilled.
The rest of the oil from the tank is put into the container.

Work out the height of the oil in the container.
Give your answer to an appropriate degree of accuracy.

..... cm

(Total for Question 14 is 5 marks)

15 The diagram below represents two towns on a map.

Diagram
accurately drawn

Scale: 1 cm represents 3 kilometres.

Work out the distance, in kilometres, between Towey and Worsley.

.....km

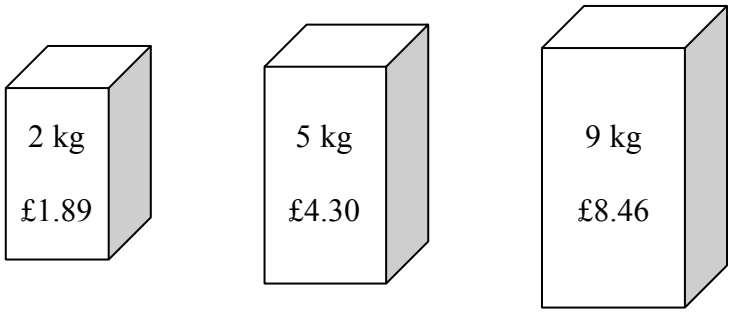
(Total for Question 15 is 2 marks)

16 Find the Highest Common Factor (HCF) of 24 and 60

.....

(Total for Question 16 is 2 marks)

17 Soap powder is sold in three sizes of box.



A 2 kg box of soap powder costs £1.89
A 5 kg box of soap powder costs £4.30
A 9 kg box of soap powder costs £8.46

Which size of box of soap powder is the best value for money?
You must show how you get your answer.

(Total for Question 17 is 3 marks)

18 $f = 5x + 2y$
$x = 3$ and $y = -2$

Find the value of f.

.....

(Total for Question 18 is 2 marks)

19 Jane made some almond biscuits which she sold at a fete.

She had:
5 kg of flour
3 kg of butter
2.5 kg of icing sugar
320 g of almonds

Here is the list of ingredients for making 24 almond biscuits.

Ingredients for 24 almond biscuits
150 g flour 100 g butter 75 g icing sugar 10 g almonds

Jane made as many almond biscuits as she could, using the ingredients she had.

Work out how many almond biscuits she made.

.....

(Total for Question 19 is 3 marks)

20 (a) Factorise $3f + 9$

.....

(1)

(b) Factorise $x^2 - 2x - 15$

.....

(2)

(Total for Question 20 is 3 marks)

21 $q = \frac{p}{r} + s$

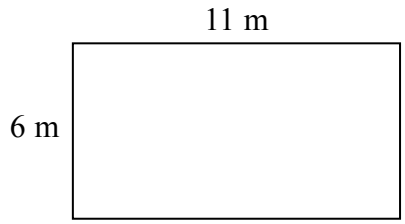
Make p the subject of this formula.

.....

(Total for Question 21 is 2 marks)

22 A tin of varnish costs £15

A rectangular floor has dimensions 6 m by 11 m.
The floor is going to be covered in varnish.



Helen assumes that each tin of this varnish covers an area of 12 m^2.

(a) Using Helen's assumption, work out the cost of buying the varnish for this floor.

£ .....

(4)

Helen finds that each tin of varnish covers less than 12 m^2.

(b) Explain how this might affect the number of tins she needs to buy.

.....

.....

(1)

(Total for Question 22 is 5 marks)

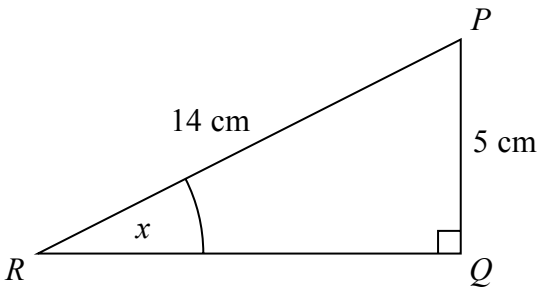
23 Frank, Mary and Seth shared some sweets in the ratio 4 : 5 : 7
Seth got 18 more sweets than Frank.

Work out the total number of sweets they shared.

.....

(Total for Question 23 is 3 marks)

24 *PQR* is a right-angled triangle.



Work out the size of the angle marked x.
Give your answer correct to 1 decimal place.

.....°

(Total for Question 24 is 2 marks)

25 Here are the first four terms of an arithmetic sequence.

6 10 14 18

(a) Write an expression, in terms of n, for the nth term of this sequence.

.....

(2)

The nth term of a different arithmetic sequence is $3n + 5$

(b) Is 108 a term of this sequence?
Show how you get your answer.

(2)

(Total for Question 25 is 4 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

26 Axel and Lethna are driving along a motorway.

They see a road sign.
The road sign shows the distance to Junction 8
It also shows the average time drivers take to get to Junction 8

To Junction 8
30 miles
26 minutes

The speed limit on the motorway is 70 mph.

Lethna says

"We will have to drive faster than the speed limit to drive 30 miles in 26 minutes."

Is Lethna right?
You must show how you get your answer.

(Total for Question 26 is 3 marks)

27 The table shows some information about the foot lengths of 40 adults.

Foot length (f cm)	Number of adults
$16 \leqslant f < 18$	3
$18 \leqslant f < 20$	6
$20 \leqslant f < 22$	10
$22 \leqslant f < 24$	12
$24 \leqslant f < 26$	9

(a) Write down the modal class interval.

.....

(1)

(b) Calculate an estimate for the mean foot length.

..... cm

(3)

(Total for Question 27 is 4 marks)

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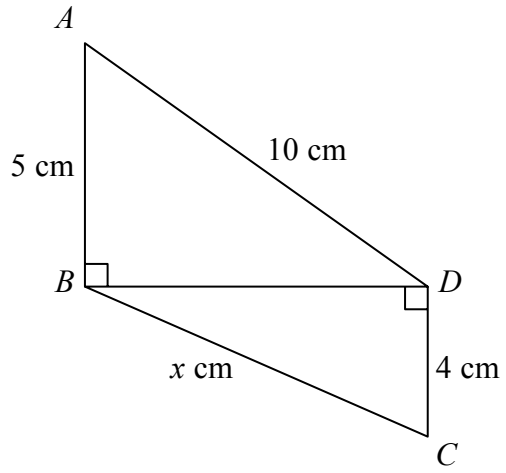
DO NOT WRITE IN THIS AREA

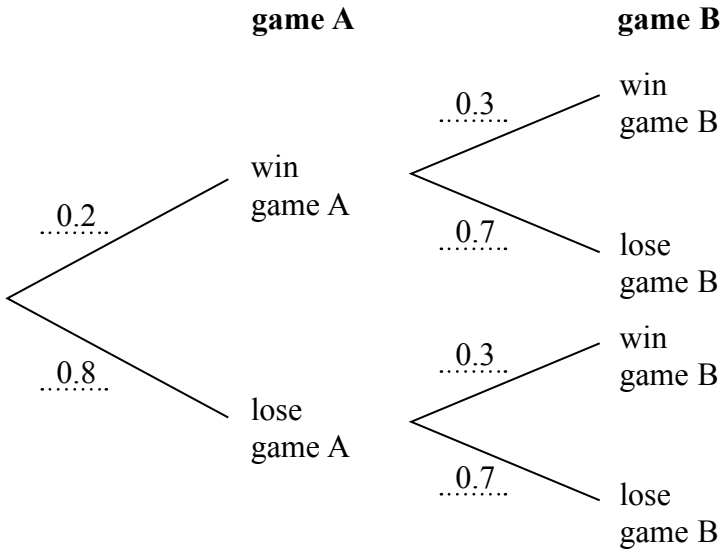
28 Triangles *ABD* and *BCD* are right-angled triangles.



Work out the value of x.
Give your answer correct to 2 decimal places.

(Total for Question 28 is 4 marks)

29 Here is a probability tree diagram.



Work out the probability of winning both games.

.....

(Total for Question 29 is 2 marks)

TOTAL FOR PAPER IS 80 MARKS

Paper 1MA1: 2F			
Question	**Working**	**Answer**	**Notes**
1		6.66	B1 cao
2		0.4375	B1 cao
3		27 or 64	B1 cao
4		7.3225	M1 for 5.5225 **or** 1.8 A1 cao
5		⅔	B1 oe
6		eg. 1, 2, 18	P1 Starts process eg. Lists at least 2 multiples from 9,18,27,36,45 **or** lists at least 2 factors from 1, 2, 4, 5, 8, 10, 20, 40 P1 Continues process eg. gives a set of numbers whose sum is greater than 20 but less than 30 but numbers may not all be appropriate factors/multiples A1 Gives 3 numbers that meet all the criteria

Paper 1MA1: 2F			
Question	**Working**	**Answer**	**Notes**
7		$\frac{53}{64}$	P1 for interpreting information e.g. recognising that the shaded area = $\frac{3}{4}+\left(\frac{1}{4}\times\frac{1}{4}\right)+\left(\frac{1}{4}\times\frac{1}{4}\times\frac{1}{4}\right)$ or adding in lines to diagram to show 64ths A1 cao
8			C1 Any one correct statement eg. No key, *y* axis label, 4 missing on *y* axis C1 Any 2nd correct statement C1 Any 3rd correct statement
9		13	M1 Puts numbers in order or clear attempt to find 5th number **or** (9 + 1)/2 **or** selects 11 A1
10 (a)		$p + c$	B1
(b)		$\frac{14}{3}$	M1 adds 5 to both sides of equation A1 oe
11 (a)		eg. $2 \times 5 = 10$	B1 example given
(b)		explanation	P1 two prime numbers identified C1 conclusion which also shows at least one calculation with prime numbers or identifies one of the prime numbers as 2.

Paper 1MA1: 2F			
Question	**Working**	**Answer**	**Notes**
12 (a)		graph	C1 introduce a scale for the *y* axis C1 plots at least 2 points correctly C1 fully correct and complete graph
(b)		15 miles (supported)	M1 reads off graph eg 20 km = 12-13 miles or 15 miles = 24 km or uses table C1 states 15 miles (24 km) with appropriate evidence
13		shown	B1 $ABC = 80$ M1 $180 - 80° - 50°$ A1 $ACB = 50$ C1 statement that since $ACB = CAB = 50°$ with reasons eg Vertically opposite angles are equal, Angles in a triangle add up to 180^o, The exterior angle of a triangle is equal to the sum of the interior opposite angles; Base angles of an isosceles triangle are equal.
14		13.9	P1 finds the volume of a cuboid eg 50×40×60 (=120000) P1 finds 35% of the oil from the cuboid eg 120000 × 0.35 oe (=42000) P1 removes 35% of oil from cuboid eg 120000 – 42000 (=78000) P1 division to find missing side length eg 78000÷(80×70) or 13.928... A1 for answer to an appropriate degree of accuracy eg (13.9 or 14 or 10)

Paper 1MA1: 2F			
Question	**Working**	**Answer**	**Notes**
15		22.5	M1 interpret information eg use the scale A1
16		12	M1 Starts to list factors of writes at least one number in terms of prime factors **or** identifies a common factor other than 1 A1 cao
17	£ per kg: 1.89÷2 = 0.945 (94.5); 4.30÷5 = 0.86 (86); 8.46÷9 = 0.94 (94) kg per £: 2÷1.89 = 1.058(2..) ; 5÷4.30 = 1.162(79…); 9÷8.46 = 1.0638(297…) Price per 90 kg: 1.89×45 = 85.05; 4.30×18 = 77.4(0); 8.46×10 = 84.6(0)	5 kg (supported)	P1 for a process (for at least two boxes) of division of price by quantity or division of quantity by price or a complete method to find price of same quantity or to find quantity of same price P1 for a complete process to give values that can be used for comparison of all 3 boxes C1 for 5 kg and correct values that can be used for comparison for all 3 boxes and a comparison of their values
18		11	M1 process of substitution demonstrated eg 5×3 + 2×−2 A1 cao

Paper 1MA1: 2F				
Question	**Working**	**Answer**	**Notes**	
19		720	P1	attempt to find the maximum biscuits for one of the ingredients e.g. 5000 ÷ 15 (=33.3..) or 2500 ÷ 75 (=33.3..) or 3000 ÷ 100 (=-30) or 320 ÷10 (=32)
			P1	for identifying butter as the limiting factor or 30 × 24 (=720) seen
			A1	
20 (a)		$3(f + 3)$	B1	cao
(b)		$(x - 5)(x + 3)$	M1	for $(x \pm 5)(x \pm 3)$
			A1	cao
21		$p=qr-sr$	M1	for multiplying all 3 terms by r or isolating p/r term
			A1	oe
22 (a)		90	P1	for the process of finding an area eg 6×11 (=66)
			P1	(dep on area calculation) for the process of working out the number of tins eg "66" ÷ 12 (=5.5 or 6 tins)
			P1	for the process of working out the cost eg "6" tins × £15
			A1	cao
(b)		reason	C1	she might need to buy more tins

Paper 1MA1: 2F						
Question	**Working**	**Answer**	**Notes**			
23		96	P1	a strategy to start to solve the problem eg 18 ÷ (7 −4) (=6)		
			P1	for completing the process of solution eg "6" × (4 + 5 + 7)		
			A1	cao		
24		20.9	M1	correct recall of appropriate formula eg $\sin x = \frac{5}{14}$		
			A1	for 20.9(248…)		
25 (a)		$4n+2$	M1	start to deduce nth term from information given eg $4n+k$ where $k \neq 2$		
			A1	cao		
(b)		No (supported)	M1	start to method that could lead to a deduction eg uses inverse operations		
			C1	for a convincing argument eg 34 is 107 so NO; (108−5)÷3 is not an integer		
26		conclusion	P1	30 ÷ 70 (=0.428)	26 ÷ 60 (=0.4333…)	30 ÷ 26 (=1.153…)
		(supported)	P1	60 × "0.428…"	70 × "0.4333…"	60× "1.153…"
			C1	for conclusion linked to 25.7 mins, 30.3 miles or 69.2 mph		

Paper 1MA1: 2F			
Question	**Working**	**Answer**	**Notes**
27 (a)		$22 \leq f < 24$	B1
(b)		21.9	M1 $x \times f$ using midpoints
			M1 (dep on previous mark) "$x \times f$" ÷ 40
			A1 accept 22 if working seen
28		9.54	P1 $10^2 - 5^2$ (=75)
			P1 "75" + 4^2 (=91)
			P1 $\sqrt{(10^2 - 5^2 + 4^2)}$
			A1 9.53 – 9.54
29		0.06	M1 for 0.2 and 0.3
			A1 cao

Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics

Paper 3 (Calculator)

Foundation Tier

Sample Assessment Materials - Issue 2
Time: 1 hour 30 minutes

Paper Reference
1MA1/3F

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out**.

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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6/4/7/4/6/6/6/

S 4 8 5 7 5 A 0 1 2 0

PEARSON

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Write 2148 correct to the nearest 100

.....

(Total for Question 1 is 1 mark)

2 (a) Simplify $8x - 3x + 2x$

.....

(1)

(b) Simplify $4y \times 2y$

.....

(1)

(Total for Question 2 is 2 marks)

3 There are 6760 people at at a rugby match.
3879 of the people are men.
1241 of the people are women.

$\frac{1}{4}$ of the children are girls.

Work out how many boys are at the rugby match.

.....

(Total for Question 3 is 3 marks)

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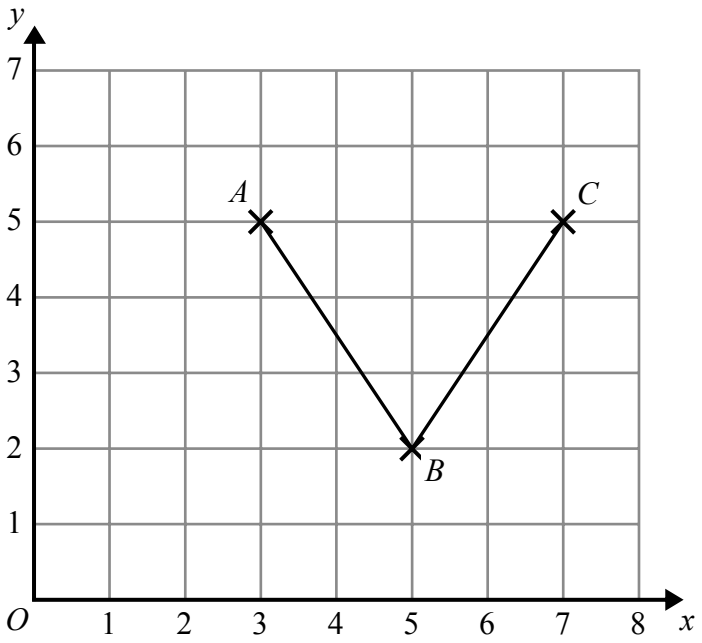
4 Here is a grid showing the points A, B and C.



(a) Write down the coordinates of the point A.

.....

(1)

(b) On the grid, mark with a cross (×) the point (1, 2).
Label this point D.

(1)

(c) On the grid, mark with a cross (×) a point E, so that the quadrilateral $ABCE$ is a kite.

(1)

(Total for Question 4 is 3 marks)

5 Faiza buys

one magazine costing £2.30
one paper costing 92p
two identical bars of chocolate

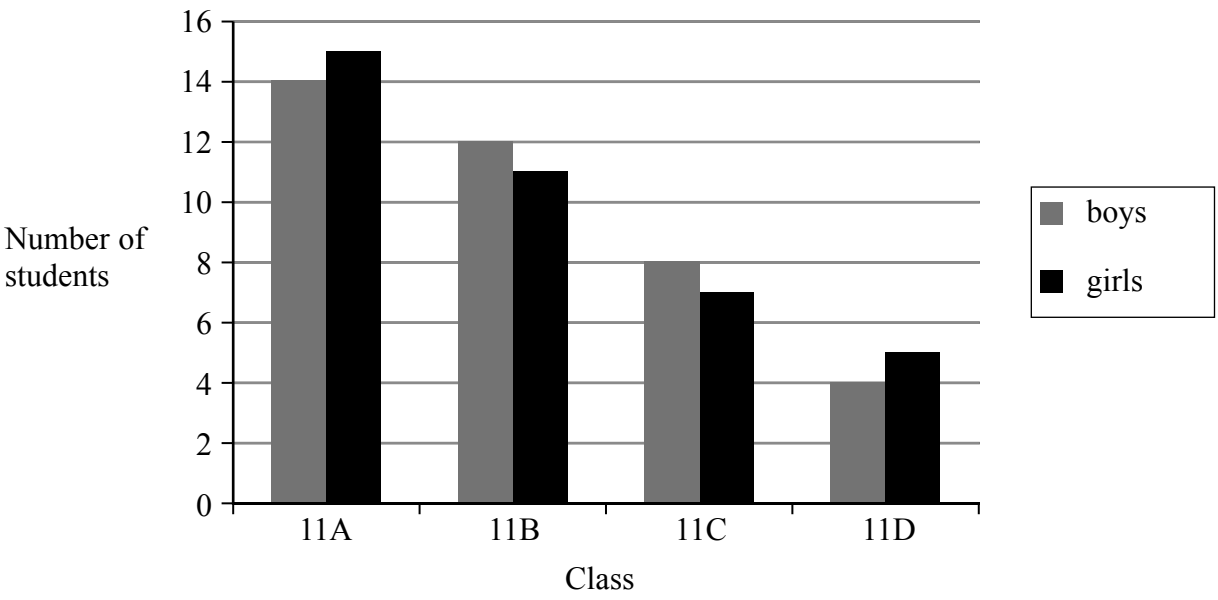
Faiza pays with a £5 note.
She gets 40p change.

Work out the cost of **one** bar of chocolate.

.....

(Total for Question 5 is 3 marks)

6 The bar chart gives information about the numbers of students in the four Year 11 classes at Trowton School.



(a) What fraction of the students in class 11A are girls?

.....

(2)

Shola says,

"There are more boys than girls in Year 11 in Trowton School."

(b) Is Shola correct?
You must give a reason for your answer.

.....

.....

(2)

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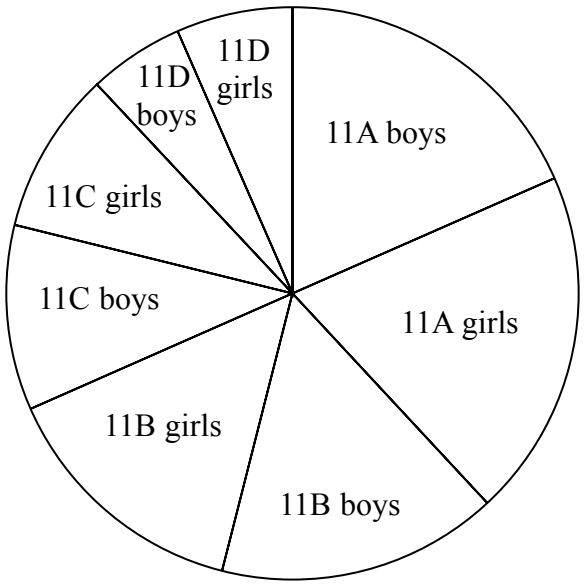
The pie chart gives information about the 76 students in the same four Year 11 classes at Trowton School.

Number of students in Year 11 of Trowton School



Tolu says,

"It is more difficult to find out the numbers of students in each class from the pie chart than from the bar chart."

(c) Is Tolu correct?
You must give a reason for your answer.

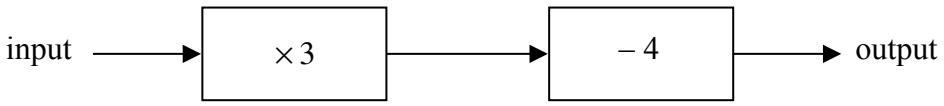
.....

.....

(1)

(Total for Question 6 is 5 marks)

7 Here is a number machine.



(a) Work out the **output** when the input is 4

.....

(1)

(b) Work out the **input** when the output is 11

.....

(2)

(c) Show that there is a value of the input for which the input and the output have the same value.

(2)

(Total for Question 7 is 5 marks)

8 1 yard is 36 inches.
10 cm is an approximation for 4 inches.

Work out an approximation for the number of cm in 2 yards.

.....

(Total for Question 8 is 3 marks)

9 Work out 234% of 150

.....

(Total for Question 9 is 2 marks)

10 Here are four numbers.

$$0.43 \qquad \frac{3}{7} \qquad 43.8\% \qquad \frac{7}{16}$$

Write these numbers in order of size.
Start with the smallest number.

.....

(Total for Question 10 is 2 marks)

11 Here is a list of five numbers.

14 15 16 17 18

From the list,

(i) write down the prime number,

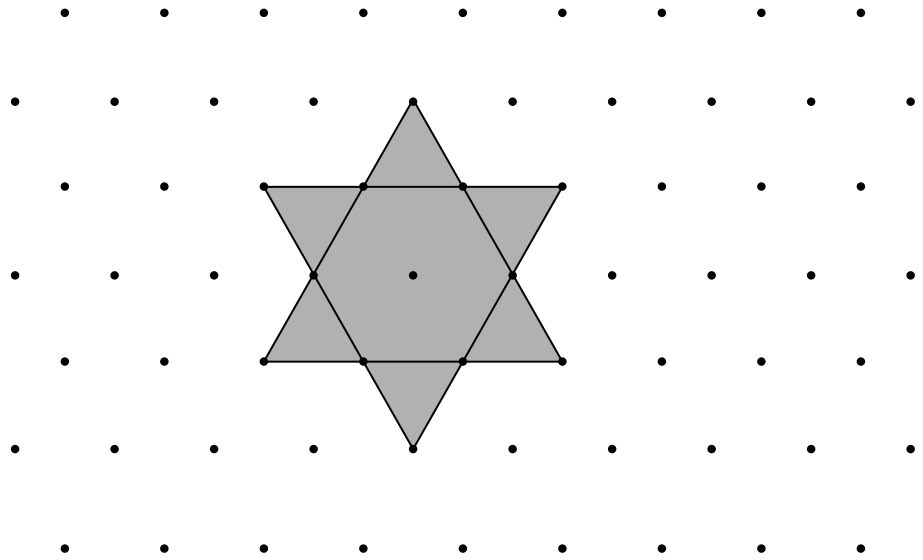
.....

(ii) write down the square number.

.....

(Total for Question 11 is 2 marks)

12 Here is a star shape.



The star shape is made from a regular hexagon and six congruent equilateral triangles.

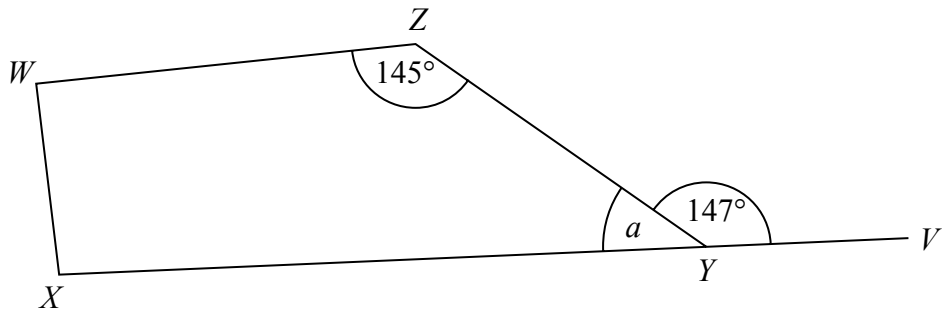
The area of the star shape is 96 cm^2.

Work out the area of the regular hexagon.

..... cm^2

(Total for Question 12 is 2 marks)

13



WXYZ is a quadrilateral.
XYV is a straight line.

(a) (i) Find the size of the angle marked *a*.

.....°

(ii) Give a reason for your answer.

.....

(2)

Angle *ZWX* = angle *WXY*

(b) Work out the size of angle *ZWX*.

.....°

(2)

(Total for Question 13 is 4 marks)

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14 The total weight of 3 tins of beans and 4 jars of jam is 2080 g.
The total weight of 5 tins of beans is 2000 g.

Work out the weight of 1 tin of beans and the weight of 1 jar of jam.

tin of beans ..... g

jar of jam ..... g

(Total for Question 14 is 4 marks)

15 There are 25 boys and 32 girls in a club.

$\frac{2}{5}$ of the boys and $\frac{1}{2}$ of the girls walk to the club.

The club leader picks at random a child from the children who walk to the club.

Work out the probability that this child is a boy.

.....

(Total for Question 15 is 3 marks)

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16 Change 72 km/h into m/s.

.....m / s

(Total for Question 16 is 3 marks)

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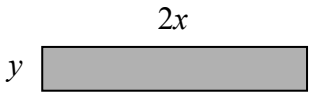
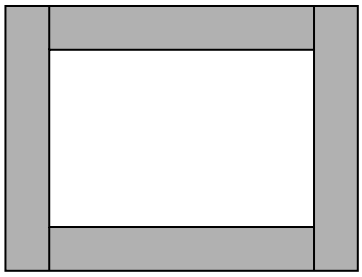
DO NOT WRITE IN THIS AREA

17 Here is a rectangle made of card.



The measurements in the diagram are in centimetres.

Lily fits four of these rectangles together to make a frame.



The perimeter of the inside of the frame is P cm.

(a) Show that $P = 8x - 4y$

(2)

Magda says,

"When x and y are whole numbers, P is always a multiple of 4."

(b) Is Magda correct?
You must give a reason for your answer.

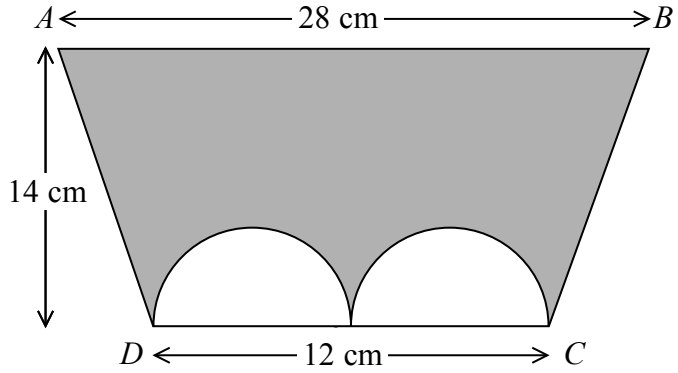
.....

.....

(2)

(Total for Question 17 is 4 marks)

18 The diagram shows a trapezium $ABCD$ and two identical semicircles.



The centre of each semicircle is on DC.

Work out the area of the shaded region.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 18 is 4 marks)

19 Asif is going on holiday to Turkey.

The exchange rate is £1 = 3.5601 lira.

Asif changes £550 to lira.

(a) Work out how many lira he should get.
Give your answer to the nearest lira.

..... lira

(2)

Asif sees a pair of shoes in Turkey.
The shoes cost 210 lira.

Asif does not have a calculator.
He uses £2 = 7 lira to work out the approximate cost of the shoes in pounds.

(b) Use £2 = 7 lira to show that the approximate cost of the shoes is £60

(2)

(c) Is using £2 = 7 lira instead of using £1 = 3.5601 lira a sensible start to Asif's method to work out the cost of the shoes in pounds?

You must give a reason for your answer.

.....

.....

(1)

(Total for Question 19 is 5 marks)

20 Here are the first six terms of a Fibonacci sequence.

1 1 2 3 5 8

The rule to continue a Fibonacci sequence is,

the next term in the sequence is the sum of the two previous terms.

(a) Find the 9th term of this sequence.

.....

(1)

The first three terms of a different Fibonacci sequence are

a b $a + b$

(b) Show that the 6th term of this sequence is $3a + 5b$

(2)

Given that the 3rd term is 7 and the 6th term is 29,

(c) find the value of a and the value of b.

$a =$ .....

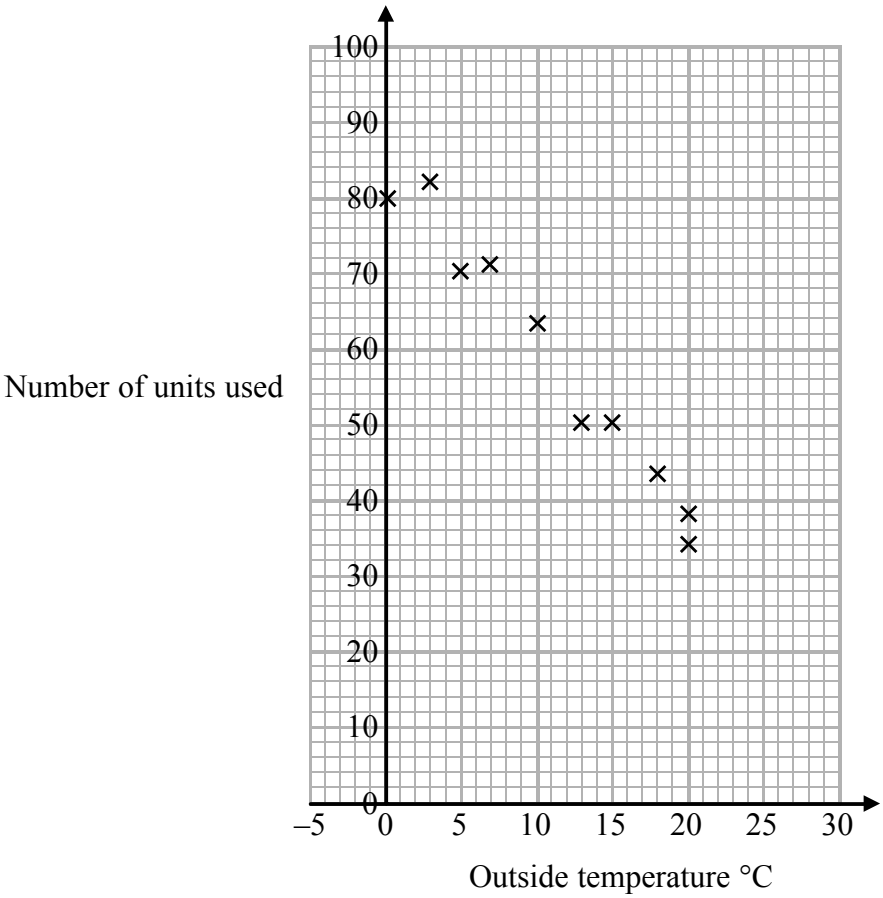
$b =$ .....

(3)

(Total for Question 20 is 6 marks)

21 In a survey, the outside temperature and the number of units of electricity used for heating were recorded for ten homes.

The scatter diagram shows this information.



Molly says,

"On average the number of units of electricity used for heating decreases by 4 units for each °C increase in outside temperature."

(a) Is Molly right?
Show how you get your answer.

.....

.....

(3)

(b) You should **not** use a line of best fit to predict the number of units of electricity used for heating when the outside temperature is 30 °C.

Give one reason why.

.....

(1)

(Total for Question 21 is 4 marks)

22 Henry is thinking of having a water meter.

These are the two ways he can pay for the water he uses.

Water Meter

A charge of £28.20 per year

plus

91.22p for every cubic metre of water used

1 cubic metre = 1000 litres

No Water Meter

A charge of £107 per year

Henry uses an average of 180 litres of water each day.

Use this information to determine whether or not Henry should have a water meter.

(Total for Question 22 is 5 marks)

23 A and B are two companies.

The table shows some information about the sales of each company and the number of workers for each company in 2004 and in 2014

	Company A		Company B	
	Sales (£ millions)	**Number of workers**	**Sales (£ millions)**	**Number of workers**
2004	320	2960	48	605
2014	388	3200	57	640

(a) Work out the percentage increase in sales from 2004 to 2014 for Company A.

..... %

(2)

(b) Which company had the most sales per worker in 2014, Company A or Company B?
You must show how you get your answer.

(3)

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

Paper 1MA1: 3F			
Question	**Working**	**Answer**	**Notes**
1		2100	B1
2 (a)		$7x$	B1
(b)		$8y^2$	B1
3		1230	P1 for start to process eg. 6760 – 3879 – 1241 (=1640)
			P1 for use of fraction eg. "1640"÷4 or $1-\frac{1}{4}\left(=\frac{3}{4}\right)$
			A1
4 (a)		(3, 5)	B1
(b)		Plotted	B1
(c)		eg. (5,6) plotted	B1
5	(500 – 230 – 92 – 40) ÷ 2	69p	P1 for start to process eg. 230 + 92 or 500 – 40
			P1 for complete process
			A1 for 69p or £0.69

<table>
<tr><th colspan="2">Paper 1MA1: 3F</th><th></th><th></th></tr>
<tr><th colspan="2">Question</th><th>Working</th><th>Answer</th><th>Notes</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>$\frac{15}{29}$</td><td>M1 for $\frac{15}{a}$ where $a > 15$ or $\frac{b}{29}$ where $b < 29$ or correct fraction for girls from a different class</td></tr>
<tr><td></td><td></td><td></td><td></td><td>A1</td></tr>
<tr><td></td><td>(b)</td><td>11A +1G, 11B −1G
11C −1G, 11D + 1G</td><td>No + reason</td><td>M1 For complete method to find the sum of the signed differences in numbers of boys and girls or the totals of boys and girls in year 11</td></tr>
<tr><td></td><td></td><td></td><td></td><td>C1 'No' with correct argument eg. there are 38 boys and 38 girls</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Yes + reason</td><td>C1 'Yes' with eg as many calculations using the angles would be required oe</td></tr>
<tr><td>7</td><td>(a)</td><td></td><td>8</td><td>B1</td></tr>
<tr><td></td><td>(b)</td><td>11 + 4 = 15
15 ÷ 3 = 5</td><td>5</td><td>M1 Start of method
A1</td></tr>
<tr><td></td><td>(c)</td><td><table><tr><td>in</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>out</td><td>-4</td><td>-1</td><td>2</td><td>5</td><td>8</td></tr></table></td><td>2</td><td>M1 For complete method that leads to answer e.g table of values or $x = 3x - 4$
C1 For 2 or for statement that the equation has a unique solution</td></tr>
<tr><td>8</td><td></td><td></td><td>180</td><td>M1 For start to method e.g. 36 ÷ 4(= 9) or 2 × 36
M1 For complete method to find no of cm in 1 yard or in 2 yards
A1</td></tr>
<tr><td>9</td><td></td><td></td><td>351</td><td>M1 for 2.34 × 150 oe
A1</td></tr>
</table>

Paper 1MA1: 3F				
Question	**Working**		**Answer**	**Notes**
10	0.43, 0.428..., 0.438. 0.4375		$\frac{3}{7}$, 0.43, $\frac{7}{16}$, 43.8%,	M1 Converts numbers to common format e.g decimals to at least 3 d.p. A1
11 (i)			17	B1
(ii)	1		16	B1
12			48	P1 For start to process eg.96 ÷ 12 **or** 96 ÷ 2 A1 cao
13 (a)(i)			33	B1 The sum of the angles on a straight line is 180^o
(ii)			The sum of the angles on a straight line is 180	B1
(b)	(360 − 33 −145) ÷ 2		91	P1 For a correct process to find angle *ZWX* A1
14	2000 ÷ 5 = 400 2080 − 3 × 400 = 880 880 ÷ 4		400, 220	B1 for 400 (weight of beans) P1 Process to find total weight of 4 jars of jam P1 Process to find weight of 1 jar of jam A1
15	25÷ 5 × 2 = 10 32 ÷ 2 = 16 $\frac{10}{10+16}$		$\frac{10}{26}$	P1 Process to find number of boys walking and number of girls walking P1 Complete process to find probability A1 $\frac{10}{26}$ oe

Paper 1MA1: 3F					
Question		**Working**	**Answer**		**Notes**
16			20	M1	for conversion of km to metres or hours to minutes
				M1	for conversion of hours to seconds
				A1	cao
17	(a)	$2x + 2x - 2y + 2x + 2x - 2y$	Shown	M1	For method to acquire correct inside lengths
				C1	For completion
	(b)	$8x$ and $4y$ are multiples of 4 Their difference must be a multiple of 4 Or $4(2x - y)$ is a multiple of 4	Shown	M1	For method to start argument eg. factorise expression
				C1	For complete argument
18			252	P1	For start to process eg. radius = 12 ÷ 4 (=3)
				M1	Method to find area of trapezium or semicircle or circle
				P1	Process to find area of the shaded region
				A1	251.7 – 252
19	(a)	550 × 3.5601	1958	M1	550 × 3.5601
				A1	
	(b)	210 ÷7 × 2 = 30 × 2 Or 60 ÷2 = 30 and 30 × 7 = 210	Shown	M1	For correct method to convert cost in UK to lira or vice versa, using Asif's approximation
				C1	Shown with correct calculations
	(c)		Correct evaluation	C1	For an evaluation e.g. It is a sensible start to the method because he can do the calculations without a calculator and 3.5 lira to the £ is a good approximation

Paper 1MA1: 3F					
Question		**Working**	**Answer**		**Notes**
20	(a)	8, 13, 21,	34	B1	cao
	(b)	$a, b, a+b, a+2b, 2a+3b$	Shown	M1	Method to show by adding pairs of successive terms $a+2b, 2a+3b$ shown
				C1	
	(c)	$3a + 5b = 29$ $a + b = 7$ $3a + 3b = 21$ $b = 4, a = 3$	$a = 3$ $b = 4$	P1 P1 A1	Process to set up two equations Process to solve equations
21	(a)	Draws LOBF Finds ht÷base = $\frac{85-20}{0-25} = -2.6$	No + reason	M1 M1 C1	Interpret question eg. draw line of best fit Start to test eg. gradient e.g. $\frac{85-20}{0-25} = -2.6$ Gradient within range ±(2 - 3) and 'no'
	(b)		The LOBF would have to be used outside the data	C1	Convincing explanation
22			Have a water meter (from working with correct figures)	P1 P1 P1 P1 A1	Process to find number of litres eg. 180 ÷ 1000 Full process to find cost per day Full process to find total cost of water used per year (accept use of alternative time period for both options) Full process with consistent units for total cost of water Correct decision from correct figures (88.13154 or correct figure for their time period)

Paper 1MA1: 3F			
Question	**Working**	**Answer**	**Notes**
23 (a)	$\frac{388-320}{320}\times 100 =$	21.25	M1 For a complete method A1 21.25%
(b)	A 388 (million) ÷ 3200 = £0.12125 million (£121 250) B 57(million) ÷ 640 = £0.0890625 million (£89062.50)	Company A + evidence	M1 Method to find sales/person for A **or** B for 2014 A1 £121 250 or £89062.50 C1 Company A with £121 250 and £89062.50

Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics

Paper 1 (Non-Calculator)

Higher Tier

Sample Assessment Materials – Issue 2
Time: 1 hour 30 minutes

Paper Reference
1MA1/1H

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may not be used.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out**.

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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S 4 8 5 7 2 A 0 1 2 0

PEARSON

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Work out 6.34×5.2

.....

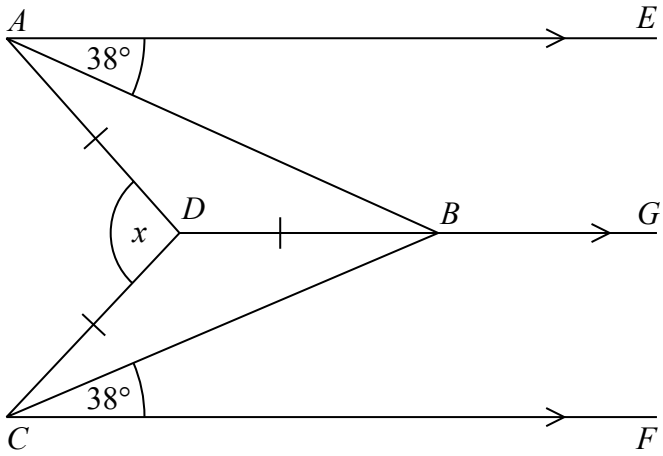
(Total for Question 1 is 3 marks)

2 Expand and simplify $(m + 7)(m + 3)$

.....

(Total for Question 2 is 2 marks)

3



AE, *DBG* and *CF* are parallel.
DA = *DB* = *DC*.
Angle *EAB* = angle *BCF* = 38°

Work out the size of the angle marked *x*.
You must show your working.

.....°

(Total for Question 3 is 3 marks)

4 Gary drove from London to Sheffield.
It took him 3 hours at an average speed of 80 km/h.

Lyn drove from London to Sheffield.
She took 5 hours.

Assuming that Lyn
drove along the same roads as Gary
and did not take a break,

(a) work out Lyn's average speed from London to Sheffield.

.....km/h

(3)

(b) If Lyn did **not** drive along the same roads as Gary, explain how this could affect your answer to part (a).

.....

.....

(1)

(Total for Question 4 is 4 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

5 In a company, the ratio of the number of men to the number of women is 3 : 2

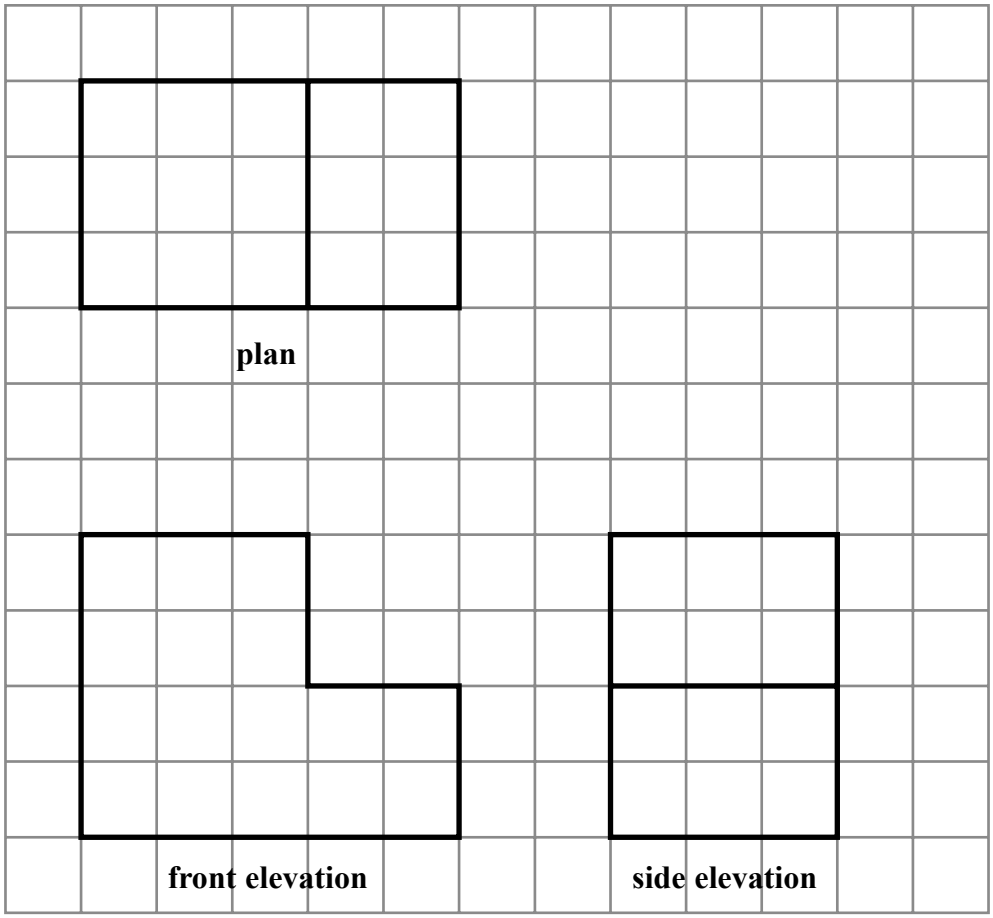
40% of the men are under the age of 25
10% of the women are under the age of 25

What percentage of all the people in the company are under the age of 25?

.....%

(Total for Question 5 is 4 marks)

6 The plan, front elevation and side elevation of a solid prism are drawn on a centimetre grid.



In the space below, draw a sketch of the solid prism.
Write the dimensions of the prism on your sketch.

(Total for Question 6 is 2 marks)

7 There are 1200 students at a school.

Kate is helping to organise a party.
She is going to order pizza.

Kate takes a sample of 60 of the students at the school.
She asks each student to tell her **one** type of pizza they want.

The table shows information about her results.

Pizza	Number of students
ham	20
salami	15
vegetarian	8
margarita	17

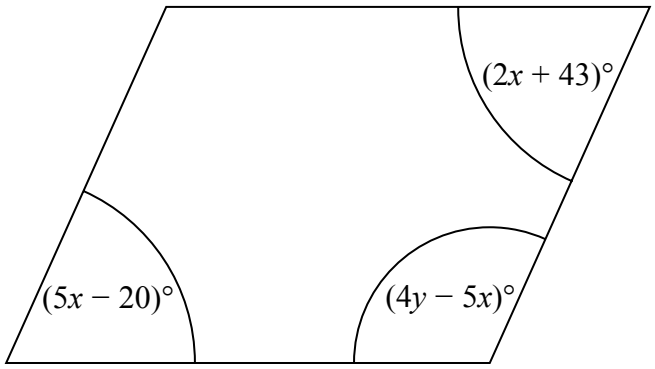
Work out how much ham pizza Kate should order.
Write down any assumption you make **and** explain how this could affect your answer.

.....

.....

(Total for Question 7 is 3 marks)

8 Here is a parallelogram.



Work out the value of x and the value of y.

$x =$ .....

$y =$ .....

(Total for Question 8 is 5 marks)

9 Work out the value of $(9 \times 10^{-4}) \times (3 \times 10^{7})$
Give your answer in standard form.

.....

(Total for Question 9 is 2 marks)

10 (a) Write down the value of $64^{\frac{1}{2}}$

.....

(1)

(b) Find the value of $\left(\frac{8}{125}\right)^{-\frac{2}{3}}$

.....

(2)

(Total for Question 10 is 3 marks)

11 One uranium atom has a mass of 3.95×10^{-22} grams.

(a) Work out an estimate for the number of uranium atoms in 1 kg of uranium.

.....

(3)

(b) Is your answer to (a) an underestimate or an overestimate?
Give a reason for your answer.

.....

.....

(1)

(Total for Question 11 is 4 marks)

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DO NOT WRITE IN THIS AREA

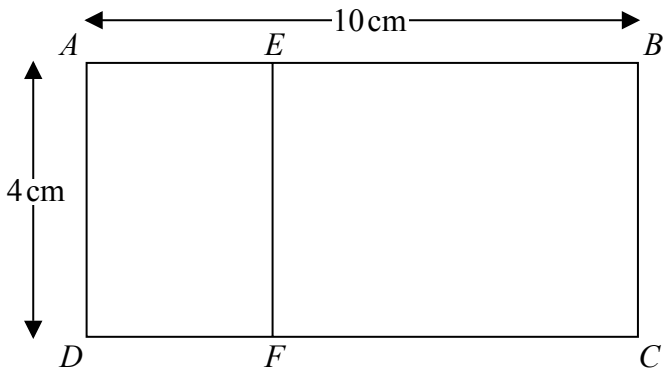
12 Pressure $= \frac{\text{force}}{\text{area}}$

Find the pressure extered by a force of 900 newtons on an area of 60 cm^2.
Give your answer in newtons/m^2.

..... newtons/m^2

(Total for Question 12 is 2 marks)

13 Rectangle *ABCD* is mathematically similar to rectangle *DAEF*.



AB = 10 cm.
AD = 4 cm.

Work out the area of rectangle *DAEF*.

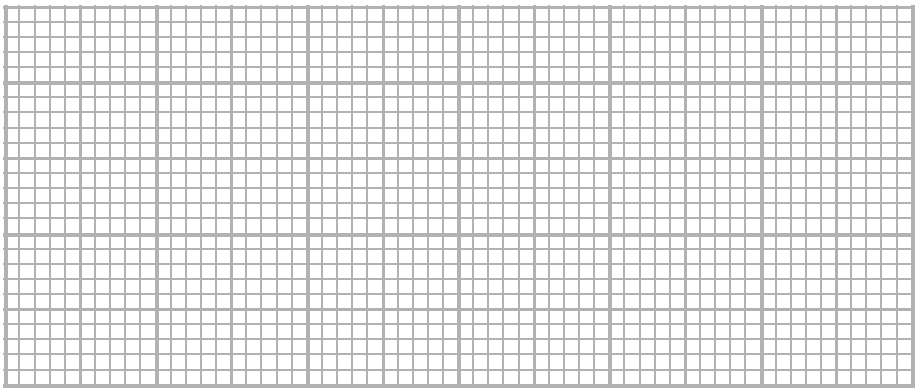
..... cm^2

(Total for Question 13 is 3 marks)

14 Ben played 15 games of basketball.
Here are the points he scored in each game.

17 18 18 18 19 20 20 22 23 23 23 26 27 28 28

(a) Draw a box plot for this information.



(3)

Sam plays in the same 15 games of basketball.

The median number of points Sam scored is 23
The interquartile range of these points is 12
The range of these points is 20

(b) Who is more consistent at scoring points, Sam or Ben?
You must give a reason for your answer.

.....

.....

.....

(2)

(Total for Question 14 is 5 marks)

15 In a shop, all normal prices are reduced by 20% to give the sale price.

The sale price of a TV set is then reduced by 30%.

Mary says,

> "30 + 20 = 50, so this means that the normal price of the TV set has been reduced by 50%."

Is Mary right?
You must give a reason for your answer.

.....

.....

.....

(Total for Question 15 is 2 marks)

16 Factorise fully $20x^2 - 5$

.....

(Total for Question 16 is 2 marks)

17 Make a the subject of $a + 3 = \dfrac{2a + 7}{r}$

.....

(Total for Question 17 is 3 marks)

18 Solid **A** and solid **B** are mathematically similar.
The ratio of the surface area of solid **A** to the surface area of solid **B** is 4 : 9

The volume of solid **B** is 405 cm^3.

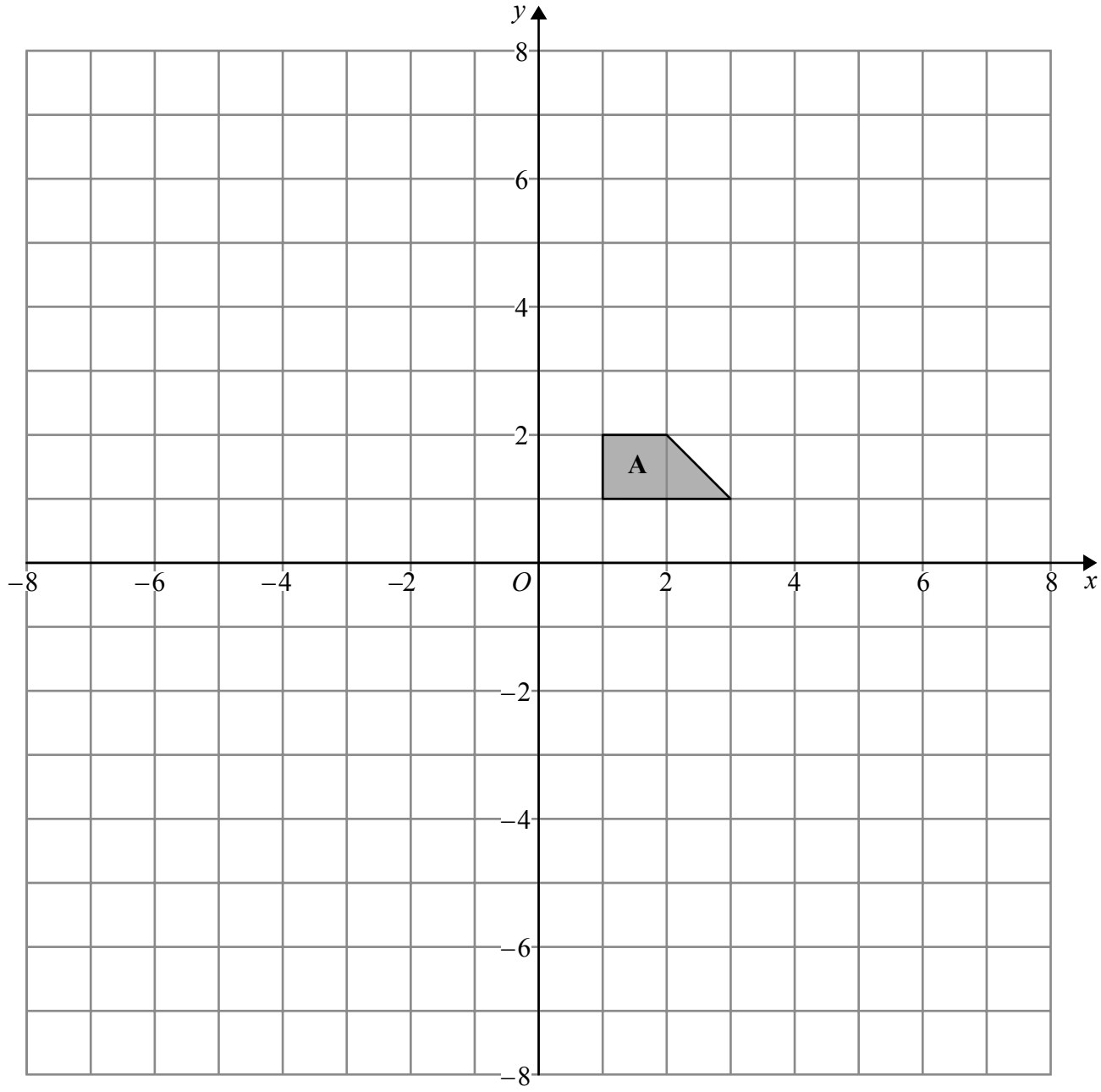
Show that the volume of solid **A** is 120 cm^3.

(Total for Question 18 is 3 marks)

19 Solve $x^2 > 3x + 4$

(Total for Question 19 is 3 marks)

20



(a) Enlarge shape **A** by scale factor −2, centre (0, 0)
Label your image **B**.

(2)

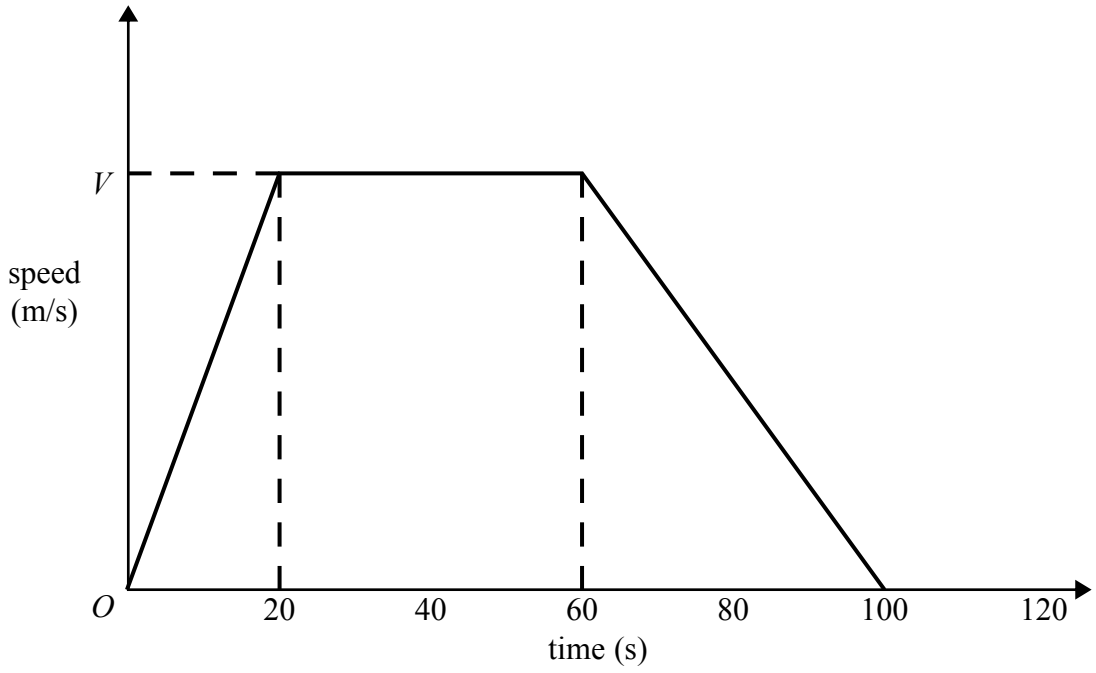
(b) Describe fully the single transformation that will map shape **B** onto shape **A**.

.....

(1)

(Total for Question 20 is 3 marks)

21 Here is a speed-time graph for a car journey.
The journey took 100 seconds.



The car travelled 1.75 km in the 100 seconds.

(a) Work out the value of V.

.....

(3)

(b) Describe the acceleration of the car for each part of this journey.

.....

.....

.....

.....

(2)

(Total for Question 21 is 5 marks)

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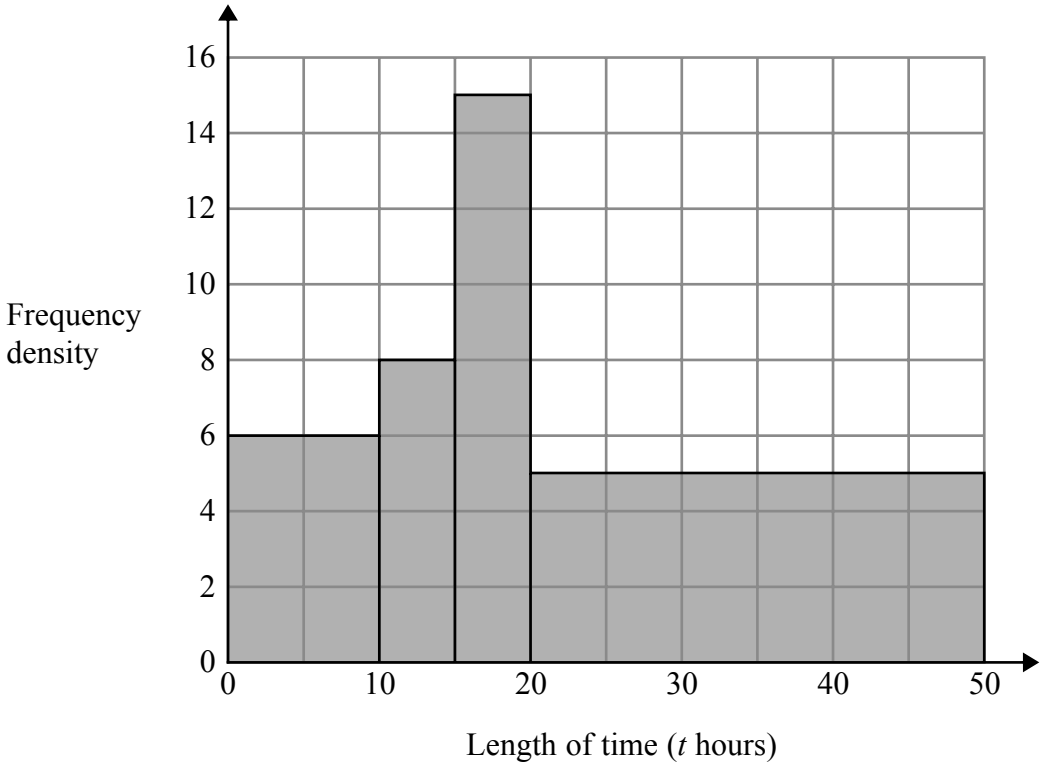
22 Bhavna recorded the lengths of time, in hours, that some adults watched TV last week.

The table shows information about her results.

Length of time (t hours)	Frequency
$0 \leqslant t < 10$	6
$10 \leqslant t < 15$	8
$15 \leqslant t < 20$	15
$20 \leqslant t < 40$	5

Bhavna made some mistakes when she drew a histogram for this information.



Write down **two** mistakes Bhavna made.

1 .....

.....

2 .....

.....

(Total for Question 22 is 2 marks)

23 Show that $\dfrac{1}{1+\dfrac{1}{\sqrt{2}}}$ can be written as $2-\sqrt{2}$

(Total for Question 23 is 3 marks)

24 John has an empty box.
He puts some red counters and some blue counters into the box.

The ratio of the number of red counters to the number of blue counters is 1 : 4

Linda takes at random 2 counters from the box.

The probability that she takes 2 red counters is $\frac{6}{155}$

How many red counters did John put into the box?

.....

(Total for Question 24 is 4 marks)

25 $A(-2, 1)$, $B(6, 5)$ and $C(4, k)$ are the vertices of a right-angled triangle ABC.
Angle ABC is the right angle.

Find an equation of the line that passes through A and C.
Give your answer in the form $ay + bx = c$ where a, b and c are integers.

(Total for Question 25 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

Paper 1MA1: 1H			
Question	**Working**	**Answer**	**Notes**
1		32.968	M1 for correct method (condone one error) A1 for digits 32968 A1 ft (dep M1) for correct placement of decimal pt
2		$m^2 + 10m + 21$	M1 for at least 3 terms out of a maximum of 4 correct from expansion A1
3		152	M1 Start to method $ABD = 38^o$ **and** BAD or DBC or $DCB = 38^o$ M1 ADB or $BDC = 180 - 2 \times 38$ (=104) A1 for 152 with working
4 (a)		48	P1 start to process eg. 3×80 (=240) P1 '240' ÷ 5 A1
(b)			C1 eg. she may drive a different distance and therefore her average speed could be different

Paper 1MA1: 1H			
Question	**Working**	**Answer**	**Notes**
5		28	P1 Process to start to solve problem eg. $\frac{3}{5}\times 40$ **or** divide any number in the ratio 3:2 P1 Second step in process to solve problem eg. $\frac{2}{5}\times 10$ or find number of males/females under 25 for candidate's chosen number P1 for complete process A1
6		Correct sketch	C1 interprets diagram eg. draw a solid shape with at least two correct dimensions C1 draws correct prism with all necessary dimensions.
7		400	P1 Start to process eg. 1200 ÷ 60 A1 400 oe (accept number of whole pizzas eg. 400÷4 = 100 with 4 people per pizza) C1 Eg. Assumption that sample is representative of population – it may not be all 1200 people are going to the party – need less pizza if they don't, assume 4 people per pizza – if different may need more/fewer pizzas

Paper 1MA1: 1H			
Question	**Working**	**Answer**	**Notes**
8		$x = 21,\ y = 50$	P1 process to start solving problem eg. form an appropriate equation P1 complete process to isolate terms in x A1 for $x = 21$ P1 complete process to find second variable A1 $y = 50$
9		2.7×10^4	M1 For evidence of a correct method eg. $27 \times 10^{-4+7}$ A1
10 (a)		8	B1
(b)		$\frac{25}{4}$ oe	M1 for correct first step A1
11 (a)		2.5×10^{24}	P1 process to estimate or divide P1 a complete process eg. $(1 \times 10^3) \div (4 \times 10^{-22})$ A1
(b)		Under-estimate	C1 ft from (i) Eg. under estimate as number rounded up but in denominator of fraction

Paper 1MA1: 1H			
Question	**Working**	**Answer**	**Notes**
12		150 000	M1 $60 \div 100^2$ **or** $900 \div 60$ **or** $900 \div$ "60" A1
13		6.4	P1 Start to process eg. find scale factor (0.4) or $\frac{AE}{4} = \frac{4}{10}$ P1 Complete process to find area A1
14 (a)	Median = 22; lq = 18; uq = 26	Box plot	C1 Start to interpret information eg. one of median, lq, uq correct C1 Starts to communicate information eg. box plot with box, whiskers and at least 3 of median, lq, uq, min and max correct C1 Correct box plot
(b)		Ben with reason	M1 interpret information eg ft from box plot to find iqr (8) or range (11) C1 ft eg. Ben with lower iqr (8) and range (11)
15		No with reason	C1 Starts to formulate reason eg. No with partial explanation or 0.8×0.7 or starts to use figures C1 No with full explanation eg. $0.8 \times 0.7 = 0.56$ so only 44% reduction
16		$5(2x + 1)(2x - 1)$	M1 for $5(4x^2 - 1)$ A1

Paper 1MA1: 1H			
Question	**Working**	**Answer**	**Notes**
17		$a = \dfrac{7-3r}{r-2}$	M1 Remove fraction and expand brackets M1 Isolate terms in a A1
18		Given result	M1 For length scale factor eg $\sqrt{\frac{4}{9}}$ **or** 120 : 405 M1 $\left(\sqrt{\frac{4}{9}}\right)^3 \times 405$ **or** $2^3 : 3^3$ (from 120 : 405) A1 120 from correct arithmetic **or** conclusion relating $2^3 : 3^3$ with $2^2 : 3^2$ with correct working
19		$x > 4$, $x < -1$	M1 rearrange quadratic and factorise M1 critical values of 4 and −1 found A1
20 (a)		(-2, -2)(-6, -2) (-2,-4) (-4, -4)	M1 Shape drawn in correct orientation A1
(b)		Enlargement sf −0.5 centre (0,0)	C1

Paper 1MA1: 1H			
Question	**Working**	**Answer**	**Notes**
21 (a)		25	C1 For interpretation eg.. area equated to 1750m P1 Process to solve equation A1
(b)		Description	C1 Start to interpret graph eg. describe or give acceleration for one stage of the journey or state that acceleration is constant in all 3 parts C1 Describe acceleration for all stages of the journey or give acceleration for all 3 stages (1.25 m/s^2 ; 0 m/s^2 ; –0.625 m/s^2)
22			C1 C1 for frequencies used for heights or areas not proportional to frequencies C1 C1 for 2nd mistake - final bar of wrong width
23		Given result	C1 Correct first step towards simplifying expression eg. $\frac{\sqrt{2}}{\sqrt{2}+1}$ C1 Correct step to rationalise denominator C1 Conclusion to given result

Paper 1MA1: 1H			
Question	**Working**	**Answer**	**Notes**
24		25	P1 For process to start to solve. Eg use of x and $4x$ or $x/5x$ and $4x/5x$ P1 process to form equation eg $\frac{x}{5x} \times \frac{x-1}{5x-1} = \frac{6}{155}$ P1 Processes to eliminate fractions and reduce equation to linear form eg. $155x - 155 = 150x - 30$ A1
25		$3y - 4x = 11$	P1 process to start to solve problem eg. draw a diagram, find gradient of AB (0.5) P1 process to use gradients eg. find gradient of BC (-2) P1 Process to find y coordinate of C (9) P1 Process to find equation of AC A1

Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics

Paper 2 (Calculator)

Higher Tier

Sample Assessment Materials – Issue 2
Time: 1 hour 30 minutes

Paper Reference
1MA1/2H

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out**.

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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S 4 8 5 7 4 A 0 1 2 0

PEARSON

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

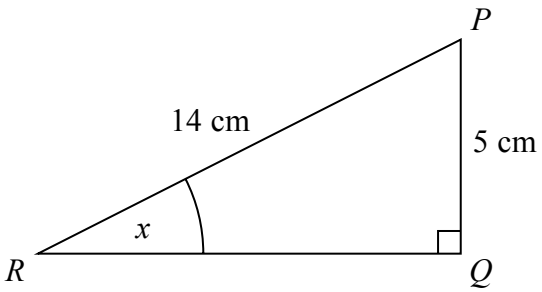
1 Frank, Mary and Seth shared some sweets in the ratio 4 : 5 : 7
Seth got 18 more sweets than Frank.

Work out the total number of sweets they shared.

.....

(Total for Question 1 is 3 marks)

2 *PQR* is a right-angled triangle.



Work out the size of the angle marked *x*.
Give your answer correct to 1 decimal place.

.....°

(Total for Question 2 is 2 marks)

3 Here are the first four terms of an arithmetic sequence.

6 10 14 18

(a) Write an expression, in terms of n, for the nth term of this sequence.

.....

(2)

The nth term of a different arithmetic sequence is $3n + 5$

(b) Is 108 a term of this sequence?
Show how you get your answer.

(2)

(Total for Question 3 is 4 marks)

4 Axel and Lethna are driving along a motorway.

They see a road sign.
The road sign shows the distance to Junction 8
It also shows the average time drivers take to get to Junction 8

To Junction 8 30 miles 26 minutes

The speed limit on the motorway is 70 mph.

Lethna says

"We will have to drive faster than the speed limit to drive 30 miles in 26 minutes."

Is Lethna right?
You must show how you get your answer.

(Total for Question 4 is 3 marks)

5 The table shows some information about the foot lengths of 40 adults.

Foot length (f cm)	Number of adults
$16 \leqslant f < 18$	3
$18 \leqslant f < 20$	6
$20 \leqslant f < 22$	10
$22 \leqslant f < 24$	12
$24 \leqslant f < 26$	9

(a) Write down the modal class interval.

.....

(1)

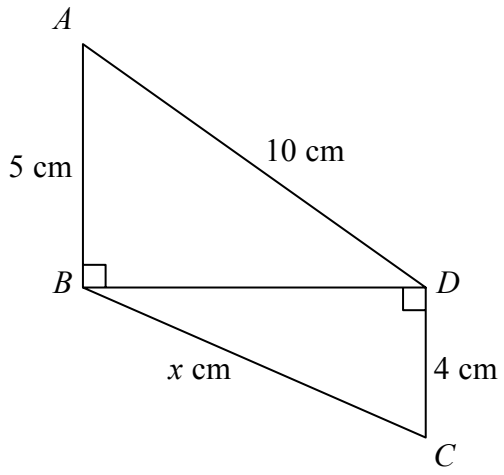
(b) Calculate an estimate for the mean foot length.

..... cm

(3)

(Total for Question 5 is 4 marks)

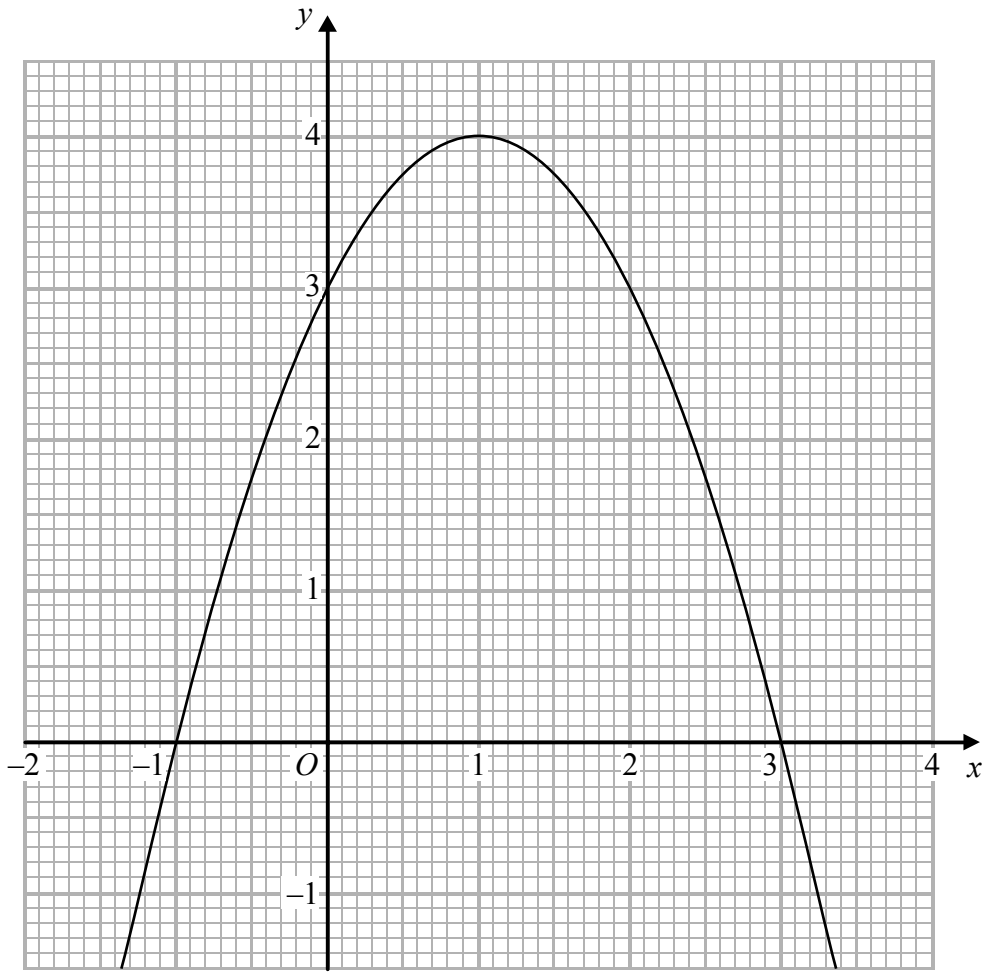
6 Triangles *ABD* and *BCD* are right-angled triangles.



Work out the value of x.
Give your answer correct to 2 decimal places.

(Total for Question 6 is 4 marks)

7 The graph of $y = f(x)$ is drawn on the grid.



(a) Write down the coordinates of the turning point of the graph.

(.....,.....)

(1)

(b) Write down the roots of $f(x) = 2$

.....

(1)

(c) Write down the value of f(0.5)

.....

(1)

(Total for Question 7 is 3 marks)

8 In a box of pens, there are

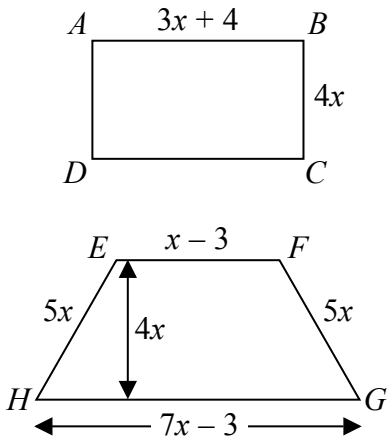
three times as many red pens as green pens
and two times as many green pens as blue pens.

For the pens in the box, write down
the ratio of the number of red pens to the number of green pens to the number of blue pens.

.....

(Total for Question 8 is 2 marks)

9 *ABCD* is a rectangle.
EFGH is a trapezium.



All measurements are in centimetres.
The perimeters of these two shapes are the same.

Work out the area of the rectangle.

..... cm^2

(Total for Question 9 is 5 marks)

10 Katy invests £2000 in a savings account for 3 years.

The account pays compound interest at an annual rate of

2.5% for the first year

x% for the second year

x% for the third year

There is a total amount of £2124.46 in the savings account at the end of 3 years.

(a) Work out the rate of interest in the second year.

.....

(4)

Katy goes to work by train.

The cost of her weekly train ticket increases by 12.5% to £225

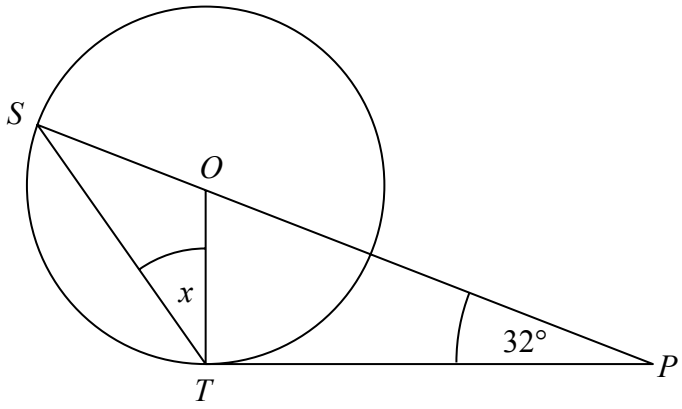
(b) Work out the cost of her weekly train ticket before this increase.

£.....

(2)

(Total for Question 10 is 6 marks)

11



S and *T* are points on the circumference of a circle, centre *O*.
PT is a tangent to the circle.
SOP is a straight line.
Angle *OPT* = 32°

Work out the size of the angle marked *x*.
You must give a reason for each stage of your working.

(Total for Question 11 is 4 marks)

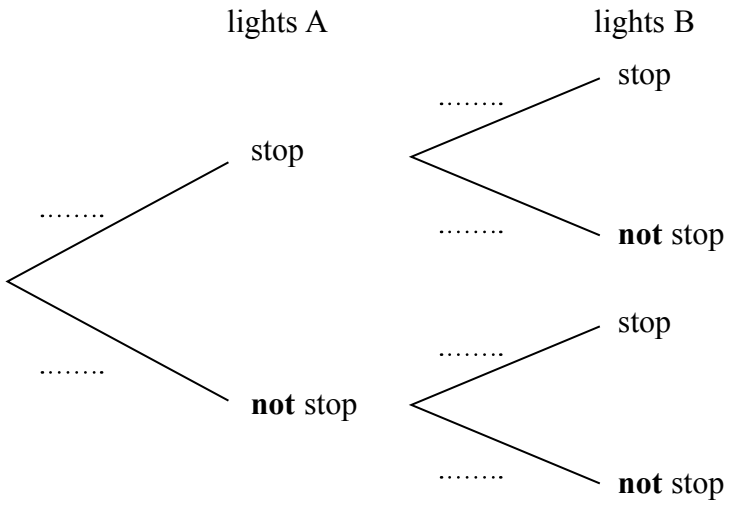
12 A and B are two sets of traffic lights on a road.

The probability that a car is stopped by lights A is 0.4

If a car is stopped by lights A, then the probability that the car is **not** stopped by lights B is 0.7

If a car is **not** stopped by lights A, then the probability that the car is **not** stopped by lights B is 0.2

(a) Complete the probability tree diagram for this information.



(2)

Mark drove along this road.
He was stopped by just one of the sets of traffic lights.

(b) Is it more likely that he was stopped by lights A or by lights B?
You must show your working.

(3)

(Total for Question 12 is 5 marks)

13 d is inversely proportional to c

When $c = 280$, $d = 25$

Find the value of d when $c = 350$

$d =$ .....

(Total for Question 13 is 3 marks)

14 Prove algebraically that

$(2n + 1)^2 - (2n + 1)$ is an even number

for all positive integer values of n.

(Total for Question 14 is 3 marks)

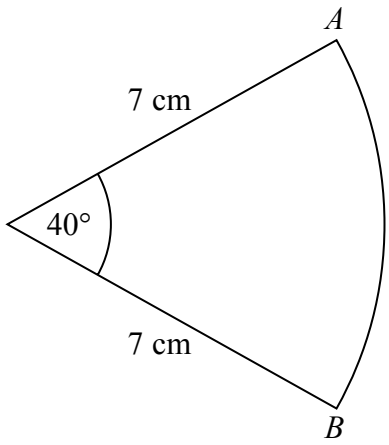
15 Prove algebraically that the recurring decimal $0.2\dot{5}$ has the value $\frac{23}{90}$

(Total for Question 15 is 2 marks)

16 Show that $\frac{1}{6x^2 + 7x - 5} \div \frac{1}{4x^2 - 1}$ simplifies to $\frac{ax + b}{cx + d}$ where a, b, c and d are integers.

(Total for Question 16 is 3 marks)

17 The diagram shows a sector of a circle of radius 7 cm.



Work out the length of arc *AB*.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 17 is 2 marks)

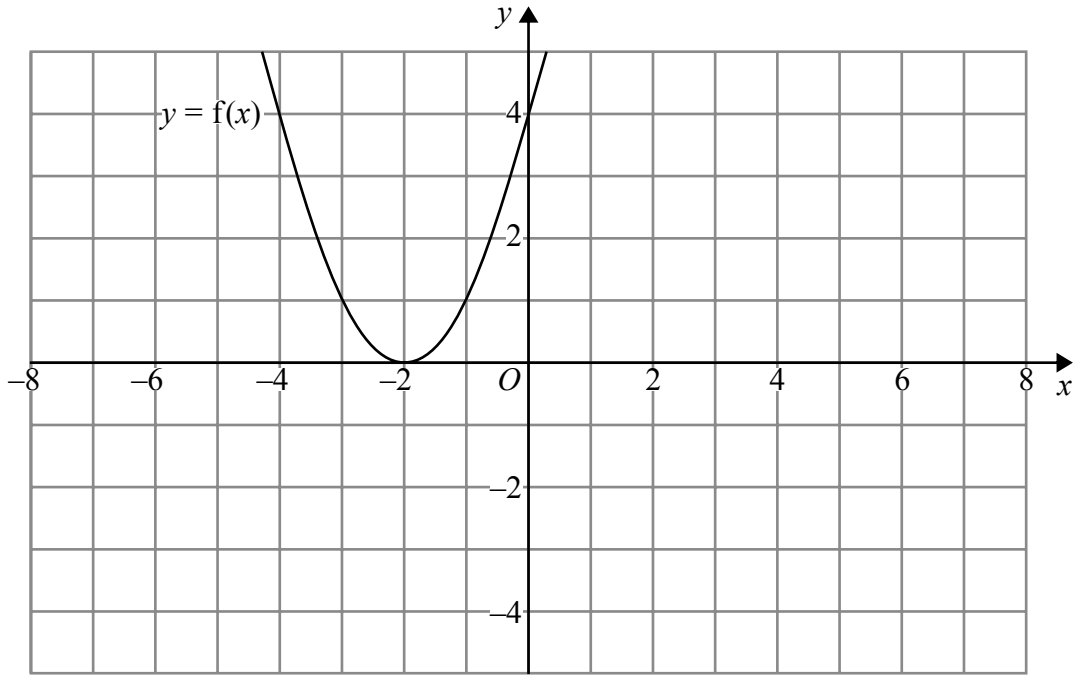
18 $m = \dfrac{\sqrt{s}}{t}$ $s = 3.47$ correct to 3 significant figures

$t = 8.132$ correct to 4 significant figures

By considering bounds, work out the value of m to a suitable degree of accuracy.
Give a reason for your answer.

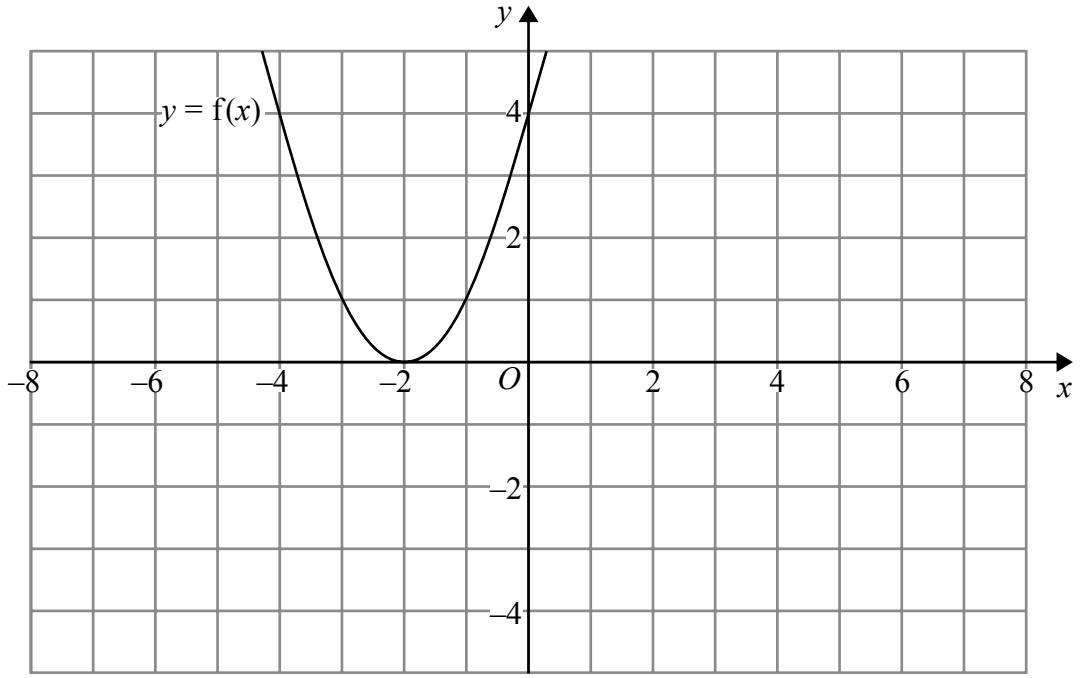
(Total for Question 18 is 5 marks)

19 The graph of $y = f(x)$ is shown on both grids below.



(a) On the grid above, sketch the graph of $y = f(-x)$

(1)



(b) On this grid, sketch the graph of $y = -f(x) + 3$

(1)

(Total for Question 19 is 2 marks)

20 Solve algebraically the simultaneous equations

$$x^2 + y^2 = 25$$
$$y - 2x = 5$$

(Total for Question 20 is 5 marks)

21 In triangle RPQ,

$RP = 8.7$ cm
$PQ = 5.2$ cm
Angle $PRQ = 32°$

(a) Assuming that angle PQR is an acute angle,
calculate the area of triangle RPQ.
Give your answer correct to 3 significant figures.

.....cm^2

(4)

(b) If you did not know that angle PQR is an acute angle, what effect would this have on your calculation of the area of triangle RPQ?

.....

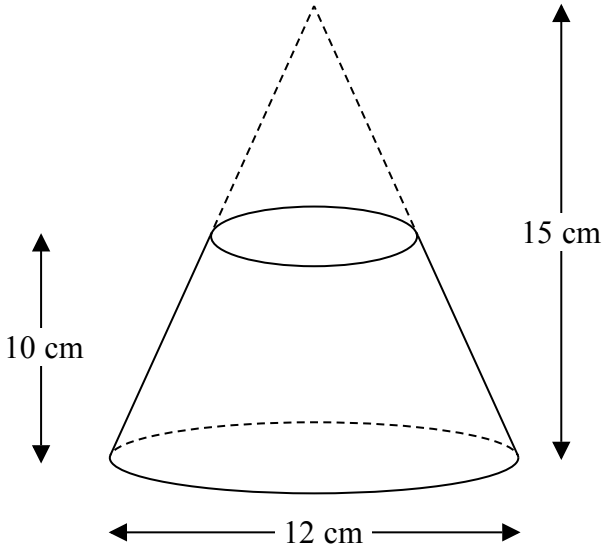
.....

.....

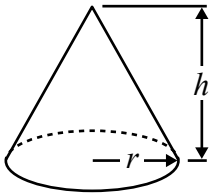
(1)

(Total for Question 21 is 5 marks)

22 A frustum is made by removing a small cone from a large cone as shown in the diagram.



Volume of cone $= \frac{1}{3}\pi r^2 h$



The frustum is made from glass.
The glass has a density of 2.5 g / cm^3

Work out the mass of the frustum.
Give your answer to an appropriate degree of accuracy.

..... g

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

Paper 1MA1: 2H			
Question	**Working**	**Answer**	**Notes**
1		96	P1 a strategy to start to solve the problem eg 18 ÷ (7 − 4) (=6) P1 for completing the process of solution eg "6" × (4 + 5 + 7) A1 cao
2		20.9	M1 correct recall of appropriate formula eg $\sin x = \frac{5}{14}$ A1 for 20.9(248…)
3 (a)		$4n+2$	M start to deduce nth term from information given eg $4n+k$ where $k \neq 2$ A1 cao
(b)		No (supported)	M1 starts method that could lead to a deduction eg uses inverse operations C1 for a convincing argument eg 34 is 107 so NO; (108−5)÷3 is not an integer
4		conclusion (supported)	P1 30 ÷ 70 (=0.428) / 26 ÷ 60 (=0.4333…) / 30 ÷ 26 (=1.153…) P1 60 × "0.428…" / 70 ×"0.4333…" / 60× "1.153…" C1 for conclusion linked to 25.7 mins, 30.3 miles or 69.2 mph

Paper 1MA1: 2H			
Question	**Working**	**Answer**	**Notes**
5 (a)		$22 \leq f < 24$	B1
(b)		21.9	M1 $x \times f$ using midpoints
			M1 (dep on previous mark) "$x \times f$" ÷ 40
			A1 accept 22 if working seen
6		9.54	P1 $10^2 - 5^2$ (=75)
			P1 "75" + 4^2 (=91)
			P1 $\sqrt{(10^2 - 5^2 + 4^2)}$
			A1 9.53 – 9.54
7 (a)		(1, 4)	B1
(b)		−0.4, 2.4	B1
(c)		3.75	B1 accept 3.7 – 3.8
8		6 : 2 : 1	M1 for correct interpretation of any one statement eg. 3 : 1; 1 : 0.5
			A1 accept any equivalent ratio eg. 3 : 1 : 0.5

Paper 1MA1: 2H			
Question	**Working**	**Answer**	**Notes**
9		203	P1 translate into algebra for rectangle: $4x+4x+3x+4+3x+4$ (=$14x+8$) or for trapezium: $5x+5x+x-3+7x-3$ (=$18x-6$) P1 equating: eg $18x-6=14x+8$ ($4x=14$) A1 solving for x: $x=14/4 = 3.5$ oe P1 process to find area: "3.5" × 3+4 (ft) or "3.5" × 4 ft A1 cao
10 (a)		1.8%	P1 for start to process eg. 2000 × 1.025 (=2050) P1 for process to use all given information eg "2050" × m^2 = 2124.46 **or** $"2050"\times\left(1+\frac{x}{100}\right)^2 = 2124.46$ P1 for process to find their unknown eg $m=\sqrt{\frac{2124.46}{2050}}(=1.01799...)$ A1 for 1.79% – 1.8 %
(b)		200	M1 225 ÷ 1.125 oe A1

Paper 1MA1: 2H				
Question	**Working**	**Answer**	**Notes**	
11		29°	C1	angle $OTP = 90^o$, quoted or shown on the diagram
			M1	method that leads to 180 – (90 + 32) or 58 shown at *TOP* OR that leads to 122 shown at *SOT*
			M1	complete method leading to "58"÷2 or (180 – "122") ÷ 2 or 29 shown at *TSP*
			C1	for angle of 29° clearly indicated and appropriate reasons linked to method eg angle between radius and tangent = 90^o and sum of angles in a triangle = 180^o; ext angle of a triangle equal to sum of int opp angles and base angles of an isos triangle are equal or angle at centre = 2x angle at circumference or ext angle of a triangle equal to sum of int opp angles
12 (a)		0.4,0.6	B1	correctly placing probs for light A eg 0.4, 0.6
		0.3,0.7,0.8,0.2	B1	correctly placing probs for light B eg 0.3, 0.7, 0.8, 0.2
(b)		B with correct	P1	(ft) eg 0.4×0.3 or 0.6×0.8 or $1-(0.28+0.12)$
		probabilities	P1	both sets of correct probability calculations
			C1	Correct interpretation of results with correct comparable results
13		20	M1	Establishing method linked to proportion eg $d=k\div c$ or $25=k\div 280$
			M1	(dep) substitution eg $d = 7000 \div 350$ or $25 \times 280 \div 350$ oe
			A1	cao

Paper 1MA1: 2H			
Question	**Working**	**Answer**	**Notes**
14	$(4n^2+2n+2n+1)$ $-(2n+1)=$ $4n^2+4n+1-2n-1$ $= 4n^2 + 2n$ $= 2n(2n + 1)$	proof (supported)	M1 for 3 out of 4 terms correct in the expansion of $(2n + 1)^2$ **or** $(2n + 1)\{(2n+1)-1\}$ P1 for $4n^2 + 2n$ or equivalent expression in factorised form C1 for convincing statement using $2n(2n + 1)$ or $2(2n^2 + n)$ or $4n^2 + 2n$ to prove the result
15		$\frac{23}{90}$	M1 For a fully complete method as far as finding two correct decimals that, when subtracted, give a terminating decimal (or integer) and showing intention to subtract eg $x = 0.2\dot{5}$ so $10x = 2.5\dot{5}$ then $9x = 2.3$ leading to… A1 correct working to conclusion
16		$\frac{2x+1}{3x+5}$	M1 for $(3x \pm 5)(2x \pm 1)$ or $(2x + 1)(2x - 1)$ M1 $\frac{1}{(3x\pm 5)(2x\pm 1)}\times(2x+1)(2x-1)$ A1
17		4.89	M1 $\frac{40}{360}\times 2\times\pi\times 7$ oe A1 4.8 – 4.9

Paper 1MA1: 2H			
Question	**Working**	**Answer**	**Notes**
18		0.229 With Explanation	B1 Finding bound of s: 3.465 or 3.475 or 3.474999… or Finding bound of t: 8.1315 or 8.1325 or 8.132499… P1 Use of "upper bound" and "lower bound" in equation P1 Process of choosing correct bounds eg $\frac{\sqrt{3.475}}{8.1315}$ or $\frac{\sqrt{3.465}}{8.1325}$ A1 For 0.2292… and 0.2288.. from correct working C1 For 0.229 from 0.2292.. and 0.2288.. since both LB and UB round to 0.229
19 (a)		Sketch	P1 Parabola passes through all three of the points (0, 4), (2,0), (4, 4)
(b)		Sketch	P1 Parabola passes through all three of the points (−4, −1), (−2,2), (0, −1)
20		x=0, y=5 x=−4, y=−3	M1 Initial process of substitution eg $x^2 + (2x + 5)^2$ (=25) M1 for expanding and simplifying eg $x^2 + 4x^2 + 10x + 10x + 25$ (=25) M1 Use of factorisation or correct substitution into quadratic formula or completing the square to solve an equation of the form $ax^2 + bx + c = 0$, $a \neq 0$ A1 correct values of x or y C1 $x = 0$, $x = -4$, $y = 5$, $y = -3$ correctly matched x and y values

Paper 1MA1: 2H			
Question	**Working**	**Answer**	**Notes**
21 (a)		130	P1 start to process eg draw a labelled triangle or use of sine rule $\frac{\sin Q}{8.7} = \frac{\sin 32}{5.2}$ P1 process to find of Q *eg* $Q = \sin^{-1}\left[\frac{\sin 32}{5.2} \times 8.7\right]$ P1 process to find area of triangle PRQ. A1 22.5 – 22.6
(b)			C1 angle PRQ is obtuse so need to find area of two triangles.
22		1361	P1 process using similar triangles to find base of small cone eg. 4 cm used as diameter or 2 cm used as radius P1 process to find volume of one cone P1 complete process to find volume of frustum P1 complete process to find mass or 1360 – 1362 A1 1361 or 1360 or 1400

Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number	Candidate Number

Mathematics

Paper 3 (Calculator)

Higher Tier

Sample Assessment Materials – Issue 2	Paper Reference
Time: 1 hour 30 minutes	**1MA1/3H**

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out**.

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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6/4/7/7/4/6/6/6/

S 4 8 5 7 6 A 0 1 2 0

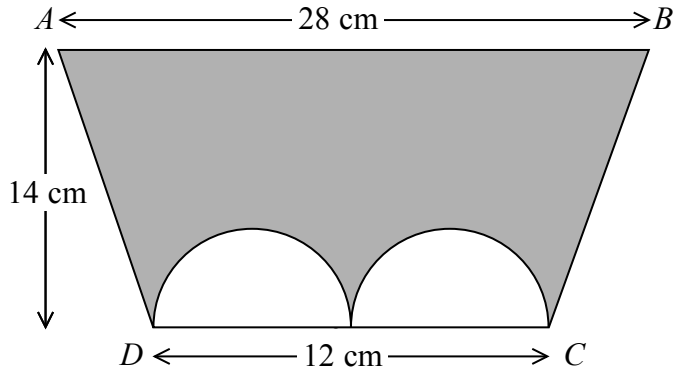
PEARSON

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 The diagram shows a trapezium $ABCD$ and two identical semicircles.



The centre of each semicircle is on DC.

Work out the area of the shaded region.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 1 is 4 marks)

2 Asif is going on holiday to Turkey.

The exchange rate is £1 = 3.5601 lira.

Asif changes £550 to lira.

(a) Work out how many lira he should get.
Give your answer to the nearest lira.

..... lira

(2)

Asif sees a pair of shoes in Turkey.
The shoes cost 210 lira.

Asif does not have a calculator.
He uses £2 = 7 lira to work out the approximate cost of the shoes in pounds.

(b) Use £2 = 7 lira to show that the approximate cost of the shoes is £60

(2)

(c) Is using £2 = 7 lira instead of using £1 = 3.5601 lira a sensible start to Asif's method to work out the cost of the shoes in pounds?

You must give a reason for your answer.

.....

.....

(1)

(Total for Question 2 is 5 marks)

3 Here are the first six terms of a Fibonacci sequence.

1 1 2 3 5 8

The rule to continue a Fibonacci sequence is,

the next term in the sequence is the sum of the two previous terms.

(a) Find the 9th term of this sequence.

.....

(1)

The first three terms of a different Fibonacci sequence are

a b $a + b$

(b) Show that the 6th term of this sequence is $3a + 5b$

(2)

Given that the 3rd term is 7 and the 6th term is 29,

(c) find the value of a and the value of b.

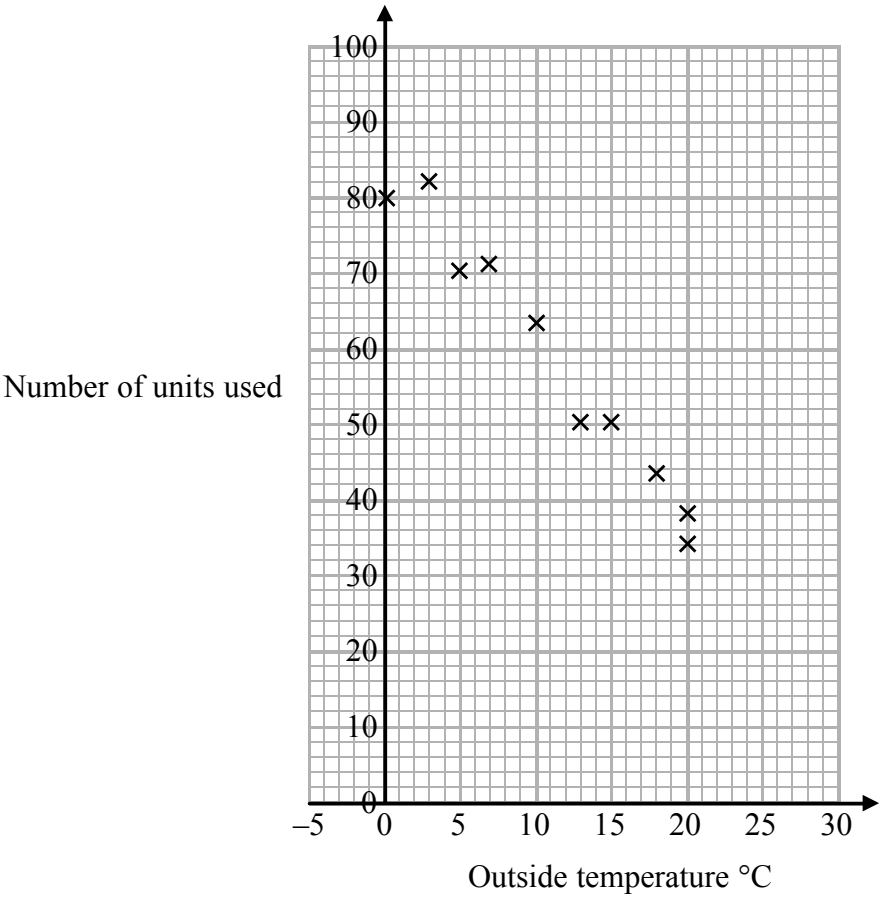
.....

(3)

(Total for Question 3 is 6 marks)

4 In a survey, the outside temperature and the number of units of electricity used for heating were recorded for ten homes.

The scatter diagram shows this information.



Molly says,

"On average the number of units of electricity used for heating decreases by 4 units for each °C increase in outside temperature."

(a) Is Molly right?
Show how you get your answer.

.....

.....

(3)

(b) You should **not** use a line of best fit to predict the number of units of electricity used for heating when the outside temperature is 30 °C.

Give one reason why.

.....

(1)

(Total for Question 4 is 4 marks)

5 Henry is thinking of having a water meter.

These are the two ways he can pay for the water he uses.

Water Meter	**No Water Meter**
A charge of £28.20 per year **plus** 91.22p for every cubic metre of water used 1 cubic metre = 1000 litres	A charge of £107 per year

Henry uses an average of 180 litres of water each day.

Use this information to determine whether or not Henry should have a water meter.

(Total for Question 5 is 5 marks)

6 Liz buys packets of coloured buttons.

There are 8 red buttons in each packet of red buttons.
There are 6 silver buttons in each packet of silver buttons.
There are 5 gold buttons in each packet of gold buttons.

Liz buys equal numbers of red buttons, silver buttons and gold buttons.

How many packets of each colour of buttons did Liz buy?

.....packets of red buttons

.....packets of silver buttons

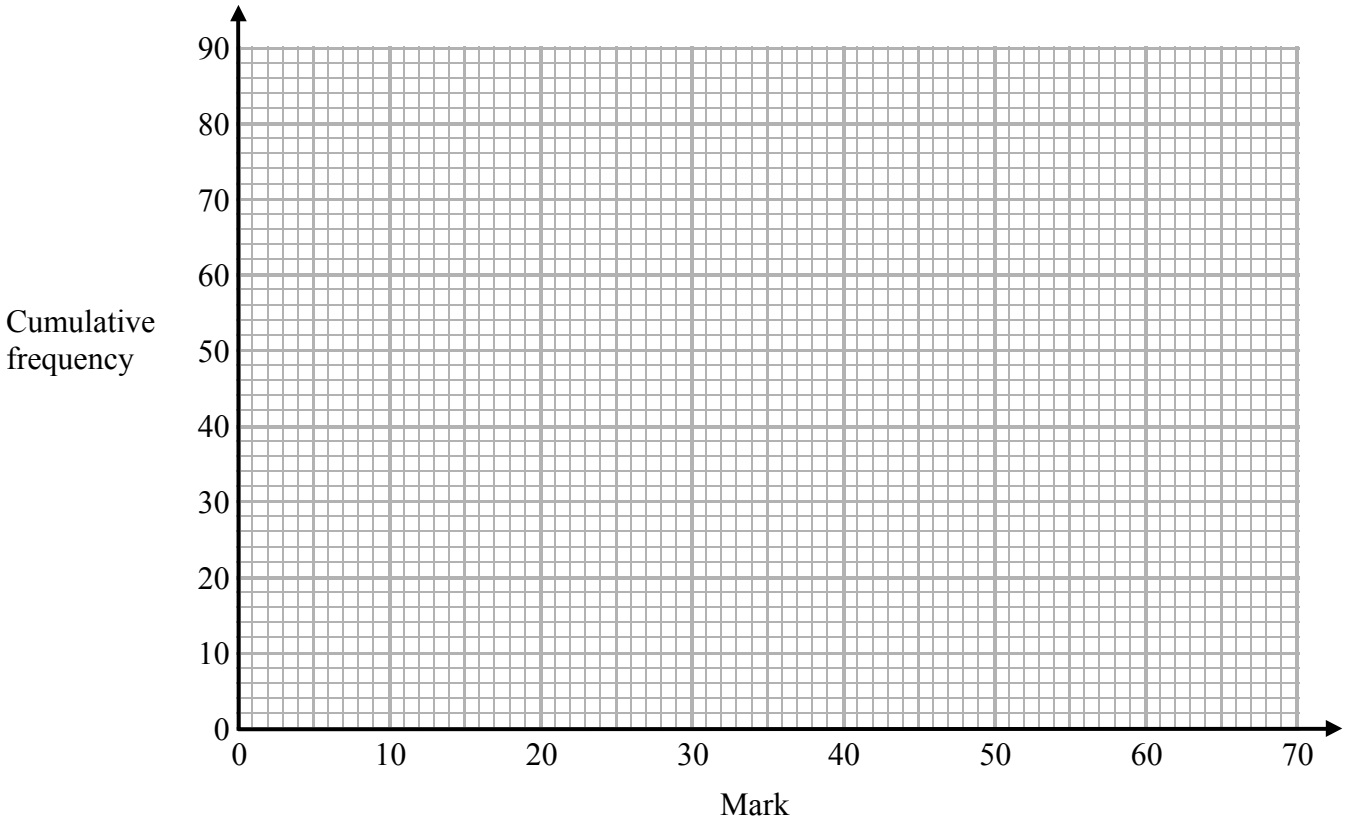
.....packets of gold buttons

(Total for Question 6 is 3 marks)

7 The cumulative frequency table shows the marks some students got in a test.

Mark (m)	Cumulative frequency
$0 < m \leqslant 10$	8
$0 < m \leqslant 20$	23
$0 < m \leqslant 30$	48
$0 < m \leqslant 40$	65
$0 < m \leqslant 50$	74
$0 < m \leqslant 60$	80

(a) On the grid, plot a cumulative frequency graph for this information.



(2)

(b) Find the median mark.

.....

(1)

Students either pass the test or fail the test.
The pass mark is set so that 3 times as many students fail the test as pass the test.

(c) Find an estimate for the lowest possible pass mark.

.....

(3)

(Total for Question 7 is 6 marks)

8 Write 0.000068 in standard form.

.....

(Total for Question 8 is 1 mark)

9 (a) Factorise $y^2 + 7y + 6$

.....

(2)

(b) Solve $6x + 4 > x + 17$

.....

(2)

(c) n is an integer with $-5 < 2n \leqslant 6$

Write down all the values of n

.....

(2)

(Total for Question 9 is 6 marks)

---

10 The function f is such that

$$f(x) = 4x - 1$$

(a) Find $f^{-1}(x)$

$f^{-1}(x) =$ .....

(2)

The function g is such that

$$g(x) = kx^2 \text{ where } k \text{ is a constant.}$$

Given that $fg(2) = 12$

(b) work out the value of k

$k =$ .....

(2)

(Total for Question 10 is 4 marks)

11 Solve $x^2 - 5x + 3 = 0$

Give your solutions correct to 3 significant figures.

.....

(Total for Question 11 is 3 marks)

12 Sami asked 50 people which drinks they liked from tea, coffee and milk.

All 50 people like at least one of the drinks
19 people like all three drinks.
16 people like tea and coffee but do **not** like milk.
21 people like coffee and milk.
24 people like tea and milk.
40 people like coffee.
1 person likes only milk.

Sami selects at random one of the 50 people.

(a) Work out the probability that this person likes tea.

.....

(4)

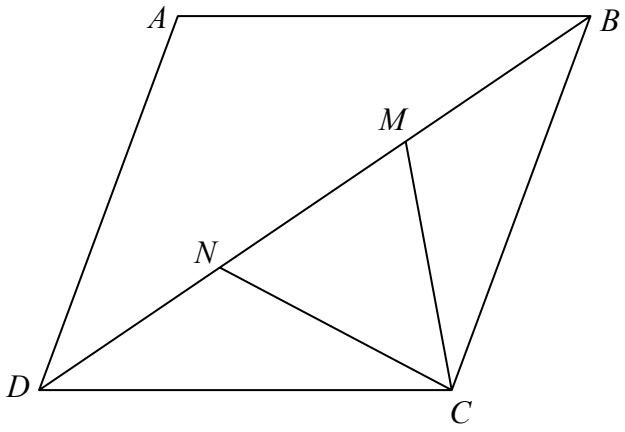
(b) Given that the person selected at random from the 50 people likes tea, find the probability that this person also likes exactly one other drink.

.....

(2)

(Total for Question 12 is 6 marks)

13 *ABCD* is a rhombus.



M and *N* are points on *BD* such that $DN = MB$.

Prove that triangle *DNC* is congruent to triangle *BMC*.

(Total for Question 13 is 3 marks)

14 (a) Show that the equation $x^3 + 4x = 1$ has a solution between $x = 0$ and $x = 1$

(2)

(b) Show that the equation $x^3 + 4x = 1$ can be arranged to give $x = \frac{1}{4} - \frac{x^3}{4}$

(1)

(c) Starting with $x_0 = 0$, use the iteration formula $x_{n+1} = \frac{1}{4} - \frac{x_n^3}{4}$ twice, to find an estimate for the solution of $x^3 + 4x = 1$

(3)

(Total for Question 14 is 6 marks)

15 There are 17 men and 26 women in a choir.
The choir is going to sing at a concert.

One of the men and one of the women are going to be chosen to make a pair to sing the first song.

(a) Work out the number of different pairs that can be chosen.

.....

(2)

Two of the men are to be chosen to make a pair to sing the second song.

Ben thinks the number of different pairs that can be chosen is 136
Mark thinks the number of different pairs that can be chosen is 272

(b) Who is correct, Ben or Mark?
Give a reason for your answer.

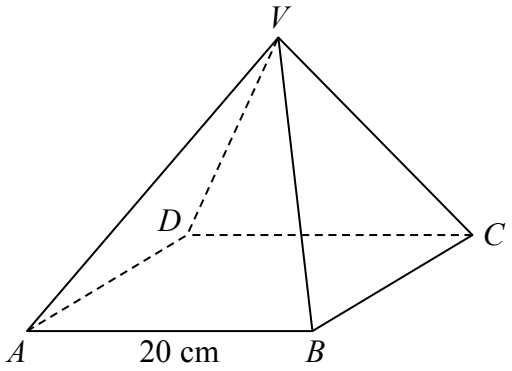
.....

.....

(1)

(Total for Question 15 is 3 marks)

16 *VABCD* is a solid pyramid.



ABCD is a square of side 20 cm.

The angle between any sloping edge and the plane *ABCD* is 55°

Calculate the surface area of the pyramid.
Give your answer correct to 2 significant figures.

.....cm^2

(Total for Question 16 is 5 marks)

17 Louis and Robert are investigating the growth in the population of a type of bacteria.
They have two flasks A and B.

At the start of day 1, there are 1000 bacteria in flask A.
The population of bacteria grows exponentially at the rate of 50% per day.

(a) Show that the population of bacteria in flask A at the start of each day forms a geometric progression.

(2)

The population of bacteria in flask A at the start of the 10th day is k times the population of bacteria in flask A at the start of the 6th day.

(b) Find the value of k.

(2)

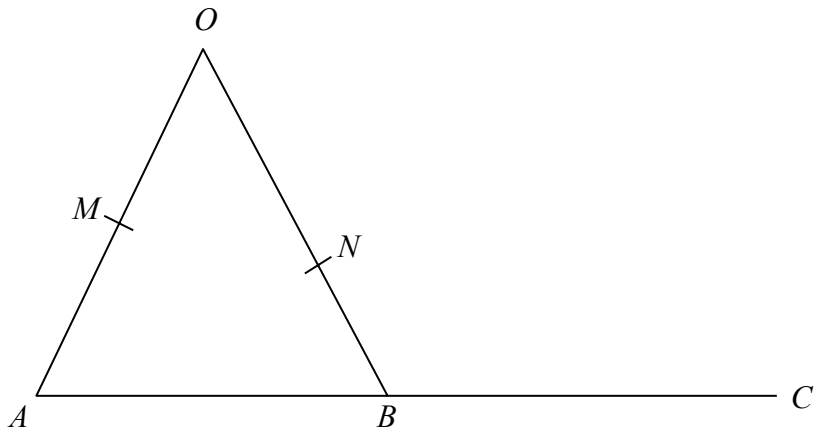
At the start of day 1 there are 1000 bacteria in flask B.
The population of bacteria in flask B grows exponentially at the rate of 30% per day.

(c) Sketch a graph to compare the size of the population of bacteria in flask A and in flask B.

(1)

(Total for Question 17 is 5 marks)

18



OMA, ONB and *ABC* are straight lines.
M is the midpoint of *OA*.
B is the midpoint of *AC*.
$\overrightarrow{OA} = 6\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$ $\overrightarrow{ON} = k\mathbf{b}$ where *k* is a scalar quantity.

Given that *MNC* is a straight line, find the value of *k*.

(Total for Question 18 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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Paper 1MA1: 3H				
Question		Working	Answer	Notes
1			252	P1 For start to process eg. radius = 12 ÷ 4 (=3) M1 Method to find area of trapezium or semicircle or circle P1 Process to find area of the shaded region A1 251.7 – 252
2	(a)	550 × 3.5601	1958	M1 550 × 3.5601 A1
	(b)	210 ÷7 × 2 = 30 × 2 Or 60 ÷2 = 30 and 30 × 7 = 210	Shown	M1 For correct method to convert cost in UK to lira or vice versa, using Asif's approximation C1 Shown with correct calculations
	(c)		Correct evaluation	C1 For an evaluation e.g. It is a sensible start to the method because he can do the calculations without a calculator and 3.5 lira to the £ is a good approximation
3	(a)	8, 13, 21,	34	B1 cao
	(b)	$a, b, a+b, a+2b, 2a+3b$	Shown	M1 Method to show by adding pairs of successive terms $a+2b, 2a+3b$ shown C1
	(c)	$3a + 5b = 29$ $a + b = 7$ $3a + 3b = 21$ $b = 4, a = 3$	$a = 3$ $b=4$	P1 Process to set up two equations P1 Process to solve equations A1

Paper 1MA1: 3H			
Question	**Working**	**Answer**	**Notes**
4 (a)	Draws LOBF Finds ht÷base = $\frac{85-20}{0-25} = -2.6$	No + reason	M1 Interpret question eg. draw line of best fit M1 Start to test eg. gradient e.g. $\frac{85-20}{0-25} = -2.6$ C1 Gradient within range ±(2 - 3) and 'no'
(b)		The LOBF would have to be used outside the data	C1 Convincing explanation
5		Have a water meter (from working with correct figures)	P1 Process to find number of litres eg. 180 ÷ 1000 P1 Full process to find cost per day P1 Full process to find total cost of water used per year (accept use of alternative time period for both options) P1 Full process with consistent units for total cost of water A1 Correct decision from correct figures (88.13154 or correct figure for their time period)
6		15, 20, 24	P1 Process to start to find common multiple eg. prime factor decomposition of 6 and 8 or list of at least 3 multiples of all numbers P1 process to find number of packets for at least colour **or** 120 identified A1

Paper 1MA1: 3H			
Question	**Working**	**Answer**	**Notes**
7 (a)		11A	M1 For a cumulative frequency diagram with at least 5 points plotted correctly at the ends of the intervals C1 For correct graph with points joined by curve or straight line segments [SC B1 if the shape of the graph is correct and 5 points of their points are **not** at the ends but consistently within each interval **and** joined.]
(b)		26.5	B1 25 – 28
(c)	$80 \div 4 \times 3 = 60$ Draw line parallel to mark axis from CF = 50	36 .5	P1 For process to find number who failed eg $80 \div 4 \times 3 = 60$ P1 Draw line parallel to mark axis from CF = "60" and read off A1 For 35 - 38
8		6.8×10^{-5}	B1

Paper 1MA1: 3H			
Question	**Working**	**Answer**	**Notes**
9 (a)		$(y+6)(y+1)$	M1 for $(y \pm 6)(y \pm 1)$
			A1
(b)	$6x - x > 17 - 4$	2.6	M1 for method to isolate terms in x in an inequality or an equation
			A1 oe eg. $\frac{13}{5}$
(c)		$-2, -1, 0, 1, 2, 3$	M1 for **or** $-2.5 < n \leq 3$ **or** $-4, -2, 0, 2, 4, 6$ **or** $-4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6$
			A1
10 (a)		$\frac{x+1}{4}$	M1 start to method eg. $y = 4x - 1$ or $x = \frac{y+1}{4}$
			A1 oe
(b)		$\frac{13}{16}$	P1 for start to process eg. f(4k) = 16k - 1 or g(2) = $\frac{12+1}{4}$
			A1

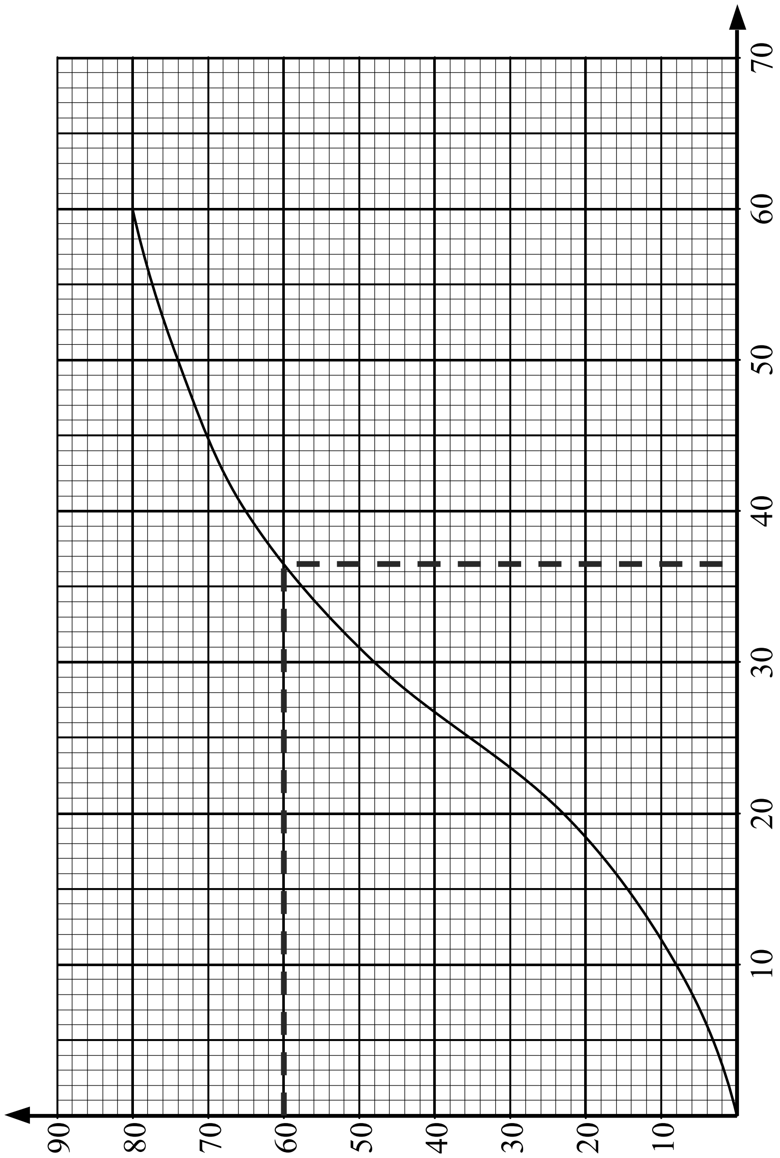
Paper 1MA1: 3H			
Question	**Working**	**Answer**	**Notes**
11	$x = \frac{--5 \pm \sqrt{(-5)^2 - 4 \times 1 \times 3}}{2} = \frac{5 \pm \sqrt{13}}{2}$	4.30 or 0.697	M1 Substitute into quadratic formula - allow sign errors M1 Evaluate as far as $\frac{5 \pm \sqrt{13}}{2}$ A1
12 (a)	Draws correct Venn diagram	$\frac{44}{50}$	M1 Begin to interpret given information e.g. 3 overlapping labelled ovals with central region correct M1 Extend interpretation of given information e.g. 3 overlapping labelled ovals with at least 5 regions correct M1 Method to communicate given information e.g. 3 overlapping labelled ovals with all regions correct including outside A1 oe
(b)		$\frac{21}{44}$	P1 For correct process to identify correct regions in Venn diagram and divide by '44' A1
13	$DN = MB$ (given) $\angle NDC = \angle MBC$ (base angles of isosceles triangle) $DC = BC$ (sides of a rhombus are equal) $\therefore \Delta DNC \equiv \Delta BMC$ (SAS)	Proof	C1 One correct relevant statement C1 All correct relevant statements C1 Correct conclusion with reasons

Paper 1MA1: 3H			
Question	**Working**	**Answer**	**Notes**
14 (a)	$F(x) = x^3 + 4x - 1$ $F(0) = -1$, $F(1) = 4$	Shown	M1 Method to establish at least one root in [0,1]e.g $x^3 + 4x - 1$ (=0) and F(0)(= −1), F(1) (= 4) oe A1 Since there is a sign change there must be at least one root in $0 < x < 1$ (as F is continuous)
(b)	$4x = 1 - x^3$ Or $\frac{x^3}{4} + x = \frac{1}{4}$	Shown	C1 C1 for at least one correct step and no incorrect ones
(c)	$x_1 = \frac{1}{4} - \frac{0}{4} = \frac{1}{4}$ $x_2 = \frac{1}{4} - \frac{\left(\frac{1}{4}\right)^3}{4} = \frac{1}{4} - \frac{1}{256}$	0.246(09375) Or $\frac{63}{256}$	B1 $x_1 = \frac{1}{4}$ M1 M1 for $x_2 = \frac{1}{4} - \frac{\left(\frac{1}{4}\right)^3}{4}$ A1 A1 for 0.246(09375) or $\frac{63}{256}$ oe
15 (a)	Number of men possible is 17 Number of women possible is 26 Each man can be paired with 26 different women 17 × 26	442	P1 Process to find number of combinations A1
(b)		Ben with reason	C1 Convincing reason e.g. correct calculation is 17 × 16 ÷ 2

Paper 1MA1: 3H			
Question	**Working**	**Answer**	**Notes**
16	$AC^2 = 20^2 + 20^2 = 800$ $AX^2 = 10^2 + 10^2 = 200$ $\sqrt{200} \times \tan 55 = VX \quad (= 20.19...)$ $VM^2 = \sqrt{"20.19"^2 + 10^2} \quad (= 22.54...)$ $4 \times \frac{1}{2} \times "22.54" \times 20 + 20^2$	1300	Let X be centre of base, M be midpoint of AB P1 process to find AC or AX P1 process to find VX or VA P1 process to find height of sloping face or angle of sloping face. P1 process to find surface area of one triangular face. A1 For 1300 – 1302
17 (a)	1000, 1500, 2250, ...	Correct Argument	M1 Method to find 1st 3 terms C1 Convincing reason e.g. common ratio is 1.5
(b)	$1000 \times 1.5^9 = k \times 1000 \times 1.5^5$ $k = \frac{1.5^9}{1.5^5}$	5.0625	P1 Process to find the value of k A1
(c)		Correct sketches	C1 Draws both exponential curves intersecting on y axis and clearly labelled

Paper 1MA1: 3H			
Question	**Working**	**Answer**	**Notes**
18	$\vec{OM}$ = **3a** $\vec{AB}$ = 6**b** – 6**a** $\vec{MC}$ = 3**a** + 2(6**b** – 6**a)** = 12**b** – 9**a** = 3(4**b** -3**a)** $\vec{MN}$ = *k***b** –3**a** *MNC* is a straight line so $\vec{MC}$ is a scalar multiple of $\vec{MN}$	4	P1 For process to start e.g. $\vec{OM}$ = 3a **or** $\vec{MA}$ = **3a** P1 For process to find $\vec{AB}$ (=6**b** – 6**a**) P1 For process to find $\vec{MC}$ (=3**a** + 2(6**b** – 6**a) and** $\vec{MN}$ (= *k***b** –3**a**) P1 For correct process to find *k* e,g. 3*k***b** - 9**a** = 12**b** - 9**a** A1

7



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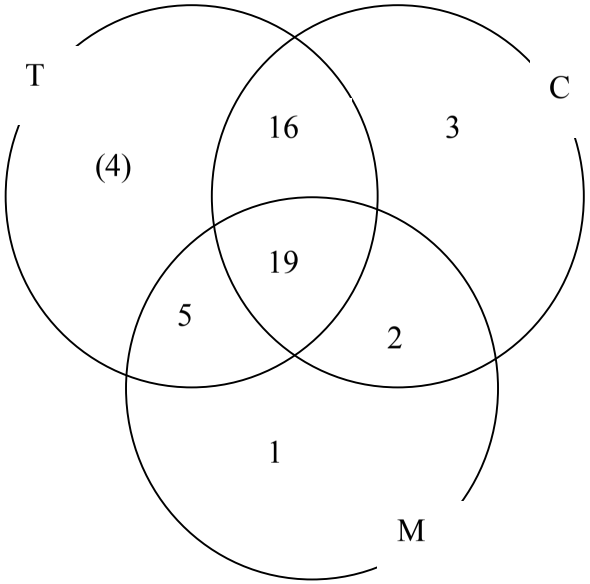

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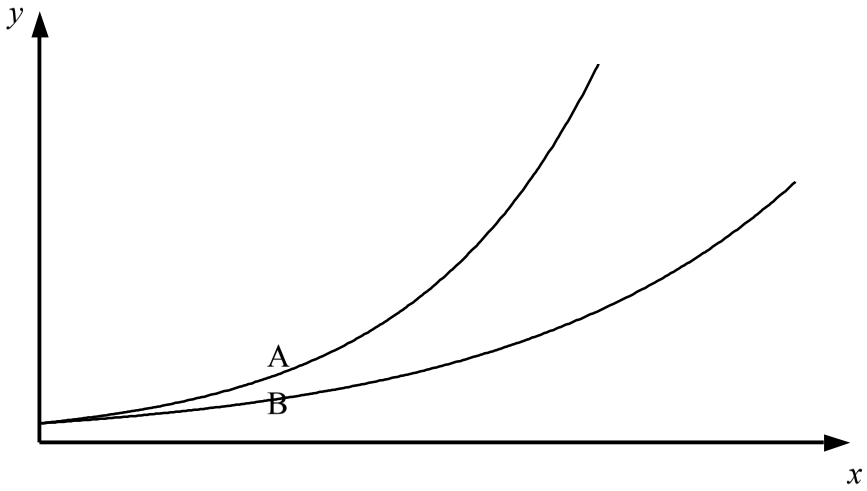

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