Maths Easter Revision Pack - Higher

How to get the most out of your Easter Revision

We have given you a sample of typical topics and questions where pupils normally lose marks. For each topic we have chosen we have included a Knowledge Organiser with facts and rules for each.

1. Formulae sheet: These are all the rules for your geometry and compound measures that you need to know by heart.
2. Flash card: Samples to show you how to make your own flash cards.
3. Knowledge organiser: Fact sheets for the 10 topics chosen
4. ***Exam style questions based on 10 most common mistakes questions from GCSE 2018 and November Mock paper:***
   - Box Plots
   - Circle Theorems
   - Algebraic Proof
   - Functions
   - Rates of change
   - Reverse Percentages
   - Area under a Curve
   - Index Form/Fractional Powers
   - Histograms
   - HCF & LCM
   - Quadratic Expressions
   - Quadratic Sequences
5. Mixed Practice questions and answers for your Memory Platform Revision
6. Revision Mat: Sample of how to do work with peers. You'll find more of these on the P:Drive

Easter revision advice

There will be plenty of other materials on the P:drive and we will also send out extra material via the email. Happy Easter and Happy Revising

Check your email for past papers, revision list, and Hegarty Exam topic list.

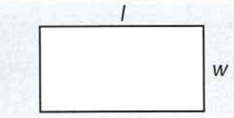
edexcel

Edexcel GCSE (9-1) Maths: need-to-know formulae

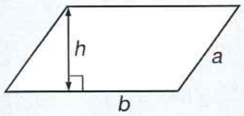
www.edexcel.com/gcsemathsformulae

Areas

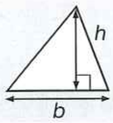
Rectangle = $l \times w$



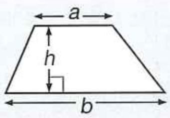
Parallelogram = $b \times h$



Triangle = $\frac{1}{2} b \times h$



Trapezium = $\frac{1}{2}(a + b)h$

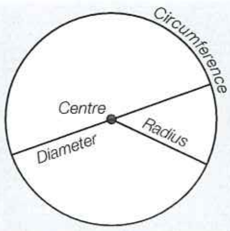


Circles

Circumference = $\pi \times$ diameter, $C = \pi d$

Circumference = $2 \times \pi \times$ radius, $C = 2\pi r$

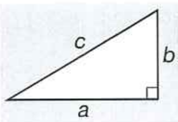
Area of a circle = $\pi \times$ radius squared, $A = \pi r^2$



Pythagoras

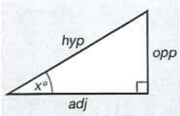
Pythagoras' Theorem

For a right-angled triangle, $a^2 + b^2 = c^2$



Trigonometric ratios (*new to F*)

$\sin x^\circ = \frac{\text{opp}}{\text{hyp}}$, $\cos x^\circ = \frac{\text{adj}}{\text{hyp}}$, $\tan x^\circ = \frac{\text{opp}}{\text{adj}}$



Quadratic equations

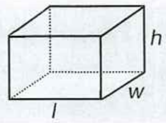
The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$,

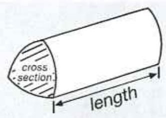
where $a \neq 0$, are given by $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Volumes

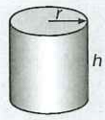
Cuboid = $l \times w \times h$



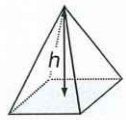
Prism = area of cross section $\times$ length



Cylinder = $\pi r^2 h$



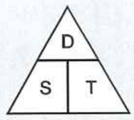
Volume of pyramid = $\frac{1}{3} \times$ area of base $\times h$



Compound measures

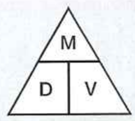
Speed

speed = $\frac{\text{distance}}{\text{time}}$



Density

density = $\frac{\text{mass}}{\text{volume}}$



Pressure

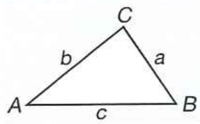
The formula for pressure does not need to be learnt, and will be given within the relevant examination questions.

Trigonometric formulae

Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle $= \frac{1}{2} ab \sin C$



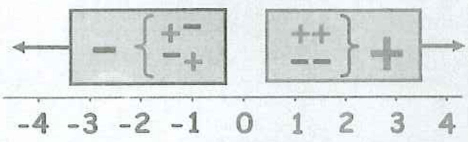
Foundation tier formulae

Higher tier formulae

Pearson

1 Positive and Negative Numbers

Addition and Subtraction



Examples

$-1+3=2$

$-1-3=-4$

$1--3=4$

$1+-3=-2$

Multiplication and Division

{ +- / -+ } −   { ++ / -- } +

$+2\times+3=+6$	$+8\div+4=+2$
$-2\times-3=+6$	$-8\div-4=+2$
$-2\times+3=-6$	$-8\div+4=-2$
$+2\times-3=-6$	$+8\div-4=-2$

2 Calculating with Fractions

Addition and Subtraction

e.g. $\frac{1}{2}+\frac{2}{3}=\frac{3}{6}+\frac{4}{6}=\frac{7}{6}=1\frac{1}{6}$

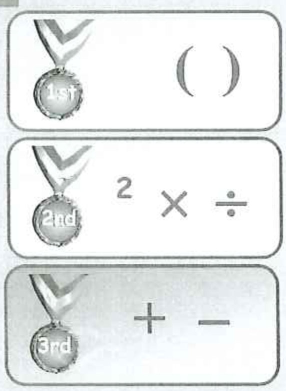
Multiplication

e.g. $\frac{5}{7}\times\frac{3}{4}=\frac{5\times3}{7\times4}=\frac{15}{28}$

Division

e.g. $\frac{2}{5}\div\frac{7}{8}=\frac{2}{5}\times\frac{8}{7}=\frac{2\times8}{5\times7}=\frac{16}{35}$

3 Order of Operations



Brackets	( )
Indices	2
Division	÷
Multiplication	×
Addition	+
Subtraction	−

4 Factors and Multiples

The factors of a number are the numbers that will go into that number without leaving a remainder.

e.g. The factors of 12 are

1, 2, 3, 4, 6 and 12

The multiples of a number are the numbers in the multiplication tables for that number.

e.g. The multiples of 5 are 5,10,15,20, ...

5 Highest Common Factor (HCF)

The HCF of two or more numbers is the highest number which is a factor of all of them.

Example

Factors of 12: (1), (2), (3), 4, (6) and 12

Factors of 18: (1), (2), (3), (6), 9 and 18

Common factors of 12 and 18: 1, 2, 3, and 6

The HCF of 12 and 18 is 6.

6 Prime Numbers

A prime number has only two factors, 1 and the number itself.

Example The only factors of 7 are 1 and 7 so 7 is a prime number.

2, 3, 5, 7, 11, 13, 17, 19...

Remember

- 1 is not a prime number
- 2 is the only even prime number.

7 Lowest Common Multiple (LCM)

The LCM of two or more numbers is the lowest number which is a multiple of all of them.

Example

Multiples of 2: 2, 4, (6), 8, 10, (12) ...

Multiples of 3: 3, (6), 9, (12), 15, (18) ...

Common multiples of 2 and 3 6, 12, 18, ...

The LCM of 2 and 3 is 6.

8 The Unique Factorisation Theorem

This theorem says that every integer greater than 1 is either prime itself or is the product of prime numbers.

Example

$60=2\times30$

$60=2\times2\times15$

$60=2\times2\times3\times5$

Product

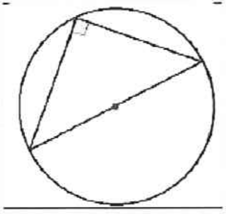
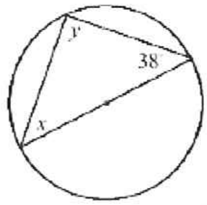
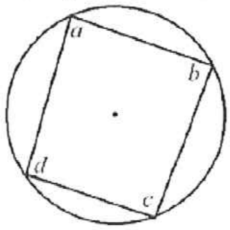
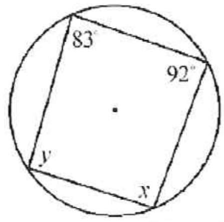
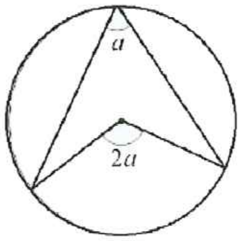
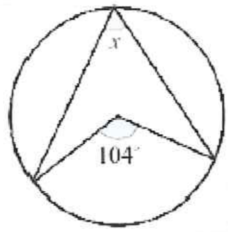
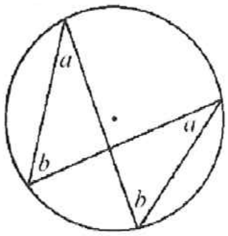
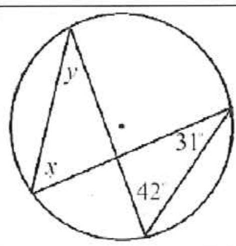
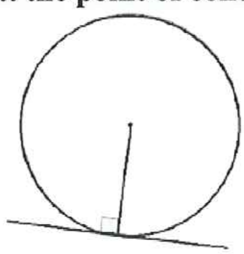
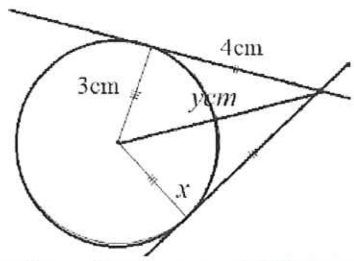
$60=2^2\times3\times5$

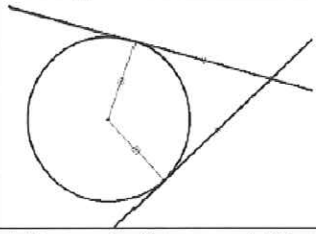
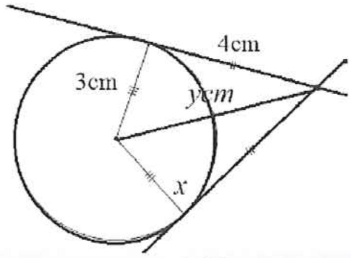
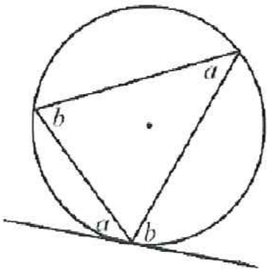
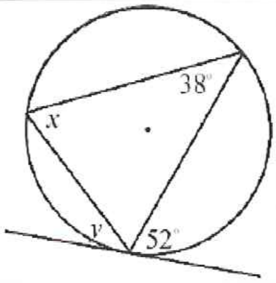
Prime Numbers

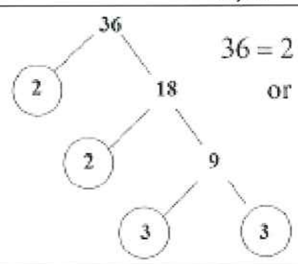
Knowledge Organiser: Fact sheets for the 10 topics chosen

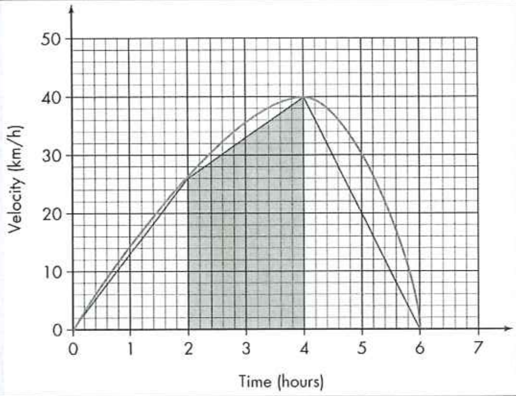
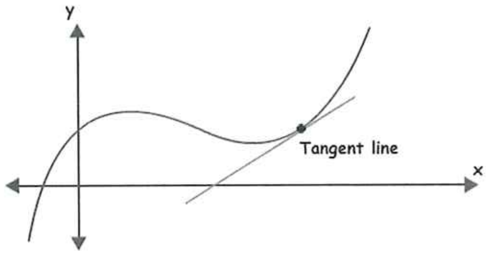
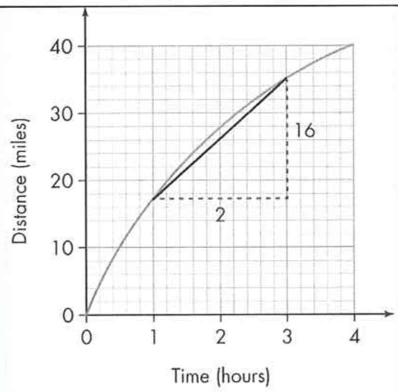
- Box plots
- Circle Theorems
- Algebraic Proof
- Functions
- Rates of Change
- Reverse Percentages
- Area under a Curve
- Index Form/Fractional Powers
- Histograms
- HCF & LCM
- Quadratic Expressions
- Quadratic Sequences

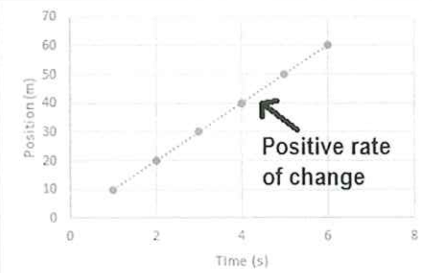
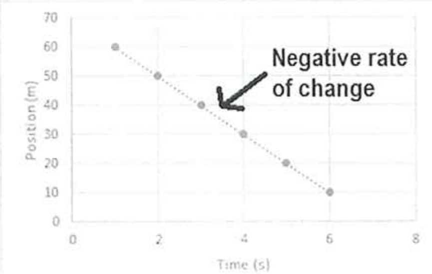
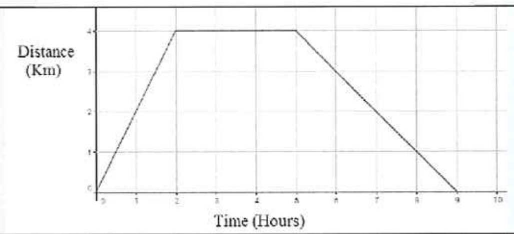
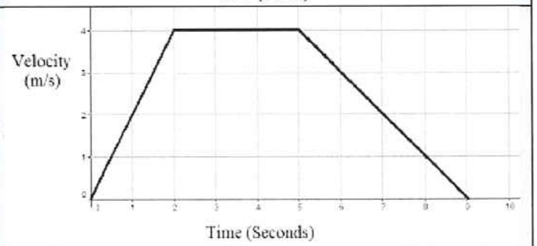
Topic: Circle Theorems

Topic/Skill	Definition/Tips	Example
Circle Theorem 1	**Angles in a semi-circle have a right angle at the circumference.** 	 $y = 90°$ $x = 180 - 90 - 38 = 52°$
Circle Theorem 2	**Opposite angles in a cyclic quadrilateral add up to 180°.**  $a + c = 180°$ $b + d = 180°$	 $x = 180 - 83 = 97°$ $y = 180 - 92 = 88°$
Circle Theorem 3	**The angle at the centre is twice the angle at the circumference.** 	 $x = 104 \div 2 = 52°$
Circle Theorem 4	**Angles in the same segment are equal.** 	 $x = 42°$ $y = 31°$
Circle Theorem 5	**A tangent is perpendicular to the radius at the point of contact.** 	 $y = 5cm$ (Pythagoras' Theorem)

Circle Theorem 6	**Tangents from an external point at equal in length.** 	 $x = 90°$
Circle Theorem 7	**Alternate Segment Theorem**  	 $x = 52°$ $y = 38°$

Topic/Skill	Definition/Tips	Example
1. Multiple	The result of multiplying a number by an integer. The **times tables** of a number.	The first five multiples of 7 are: $7, 14, 21, 28, 35$
2. Factor	A number that **divides exactly** into another number without a remainder. It is useful to write factors in pairs	The factors of 18 are: $1, 2, 3, 6, 9, 18$ The factor pairs of 18 are: $1, 18$ $2, 9$ $3, 6$
3. Lowest Common Multiple (LCM)	The **smallest** number that is in the **times tables** of each of the numbers given.	The LCM of 3, 4 and 5 is 60 because it is the smallest number in the 3, 4 and 5 times tables.
4. Highest Common Factor (HCF)	The **biggest** number that **divides exactly** into two or more numbers.	The HCF of 6 and 9 is 3 because it is the biggest number that divides into 6 and 9 exactly.
5. Prime Number	A number with **exactly two factors**. A number that can only be divided by itself and one. The number **1 is not prime**, as it only has one factor, not two.	The first ten prime numbers are: $2, 3, 5, 7, 11, 13, 17, 19, 23, 29$
6. Prime Factor	A factor which is a prime number.	The prime factors of 18 are: $2, 3$
7. Product of Prime Factors	Finding out which **prime numbers multiply** together to make the **original** number. Use a **prime factor tree.** Also known as 'prime factorisation'.	 $36 = 2 \times 2 \times 3 \times 3$ or $2^2 \times 3^2$

Topic/Skill	Definition/Tips	Example
1. Area Under a Curve	To find the area under a curve, **split it up into simpler shapes** – such as rectangles, triangles and trapeziums – that approximate the area.	
2. Tangent to a Curve	A straight **line** that **touches** a curve at **exactly one point**.	
3. Gradient of a Curve	The **gradient of a curve** at a point is the same as the **gradient of the tangent** at that point. 1. Draw a tangent carefully at the point. 2. Make a right-angled triangle. 3. Use the measurements on the axes to calculate the rise and run (change in y and change in x) 4. Calculate the gradient.	 $Gradient = \frac{Change\ in\ y}{Change\ in\ x}$ $= \frac{16}{2} = 8$

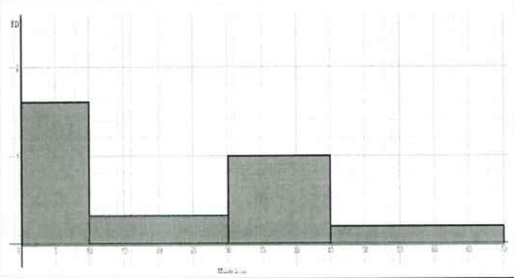
4. Rate of Change	The rate of change at a particular instant in time is represented by the **gradient of the tangent to the curve** at that point.	 
5. Distance-Time Graphs	You can find the **speed** from the **gradient** of the line (Distance ÷ Time) The steeper the line, the quicker the speed. A **horizontal** line means the object is not moving (**stationary**).	
6. Velocity-Time Graphs	You can find the **acceleration** from the **gradient** of the line (Change in Velocity ÷ Time) The steeper the line, the quicker the acceleration. A **horizontal line** represents no acceleration, meaning a **constant velocity**. The **area** under the graph is the **distance.**	

Topic: Histograms and Cumulative Frequency

<table>
<tr><th>Topic/Skill</th><th>Definition/Tips</th><th>Example</th></tr>
<tr>
<td>1. Histograms</td>
<td>A visual way to display frequency data using bars.

Bars can be unequal in width.

Histograms show frequency density on the y-axis, not frequency.

$$\textbf{Frequency Density} = \frac{\textbf{Frequency}}{\textbf{Class Width}}$$
<table>
<tr><th>Height(cm)</th><th>Frequency</th></tr>
<tr><td>$0 < h \leq 10$</td><td>8</td></tr>
<tr><td>$10 < h \leq 30$</td><td>6</td></tr>
<tr><td>$30 < h \leq 45$</td><td>15</td></tr>
<tr><td>$45 < h \leq 70$</td><td>5</td></tr>
</table>
</td>
<td>
<table>
<tr><th>Frequency Density (FD)</th></tr>
<tr><td>$8 \div 5 = 1.6$</td></tr>
<tr><td>$6 \div 20 = 0.3$</td></tr>
<tr><td>$15 \div 15 = 1$</td></tr>
<tr><td>$5 \div 25 = 0.2$</td></tr>
</table>

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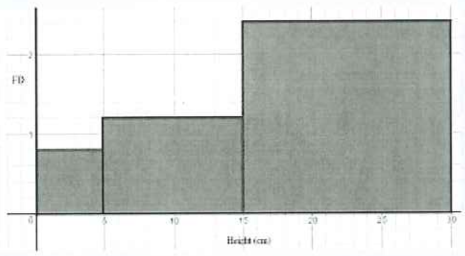
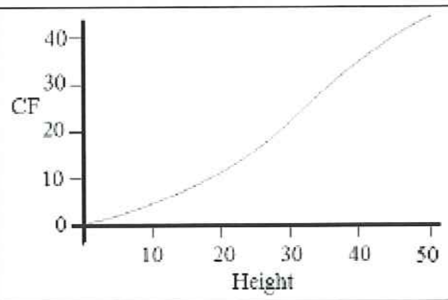
<tr>
<td>2. Interpreting Histograms</td>
<td>The area of the bar is proportional to the frequency of that class interval.

$$\textbf{Frequency} = \textbf{Freq Density} \times \textbf{Class Width}$$</td>
<td>A histogram shows information about the heights of a number of plants. 4 plants were less than 5cm tall. Find the number of plants more than 5cm tall.



Above 5cm:
1.2 x 10 + 2.4 x 15 = 12 + 36 = 48</td>
</tr>
<tr>
<td>3. Cumulative Frequency</td>
<td>Cumulative Frequency is a running total.
<table>
<tr><th>Age</th><th>Frequency</th></tr>
<tr><td>$0 < a \leq 10$</td><td>15</td></tr>
<tr><td>$10 < a \leq 40$</td><td>35</td></tr>
<tr><td>$40 < a \leq 50$</td><td>10</td></tr>
</table>
</td>
<td>
<table>
<tr><th>Cumulative Frequency</th></tr>
<tr><td>15</td></tr>
<tr><td>15 + 35 = 50</td></tr>
<tr><td>50 + 10 = 60</td></tr>
</table>
</td>
</tr>
<tr>
<td>4. Cumulative Frequency Diagram</td>
<td>A cumulative frequency diagram is a curve that goes up. It looks a little like a stretched-out S shape.

Plot the cumulative frequencies at the end-point of each interval.</td>
<td>
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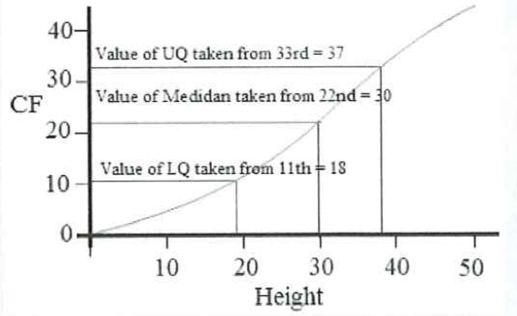
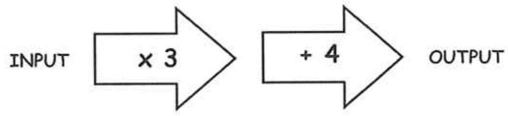
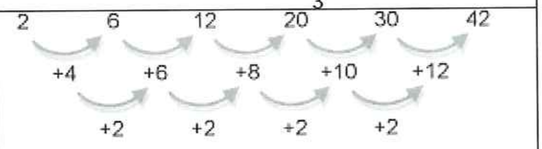
</tr>
</table>

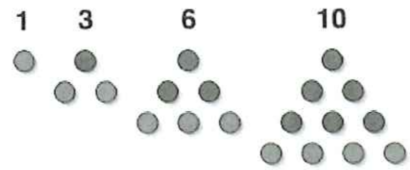
5. Quartiles from Cumulative Frequency Diagram	**Lower Quartile** (Q1): **25%** of the data is less than the lower quartile. **Median** (Q2): **50%** of the data is less than the median. **Upper Quartile** (Q3): **75%** of the data is less than the upper quartile. **Interquartile Range (IQR)**: represents the **middle 50%** of the data.	 $IQR = 37 - 18 = 19$
6. Hypothesis	**A statement that might be true, which can be tested.**	Hypothesis: 'Large dogs are better at catching tennis balls than small dogs'. We can test this hypothesis by having hundreds of different sized dogs try to catch tennis balls.

Subject: Maths **Topic: Functions**

Topic/Skill	Definition/Tips	Example
1. Function Machine	Takes an **input** value, performs some **operations** and produces an **output** value.	
2. Function	A **relationship** between two sets of values.	$f(x) = 3x^2 - 5$ 'For any input value, square the term, then multiply by 3, then subtract 5'.
3. Function notation	$f(x)$ $\boldsymbol{x}$ is the **input** value $\boldsymbol{f(x)}$ is the **output** value.	$f(x) = 3x + 11$ Suppose the input value is $x = 5$ The output value is $f(5) = 3 \times 5 + 11 = 26$
4. Inverse function	$f^{-1}(x)$ A function that performs the **opposite process** of the original function. 1. Write the function as $y = f(x)$ 2. Rearrange to make x the subject. 3. Replace the $\boldsymbol{y}$ **with** $\boldsymbol{x}$ and the $\boldsymbol{x}$ **with** $\boldsymbol{f^{-1}(x)}$	$f(x) = (1 - 2x)^5$. Find the inverse. $y = (1 - 2x)^5$ $\sqrt[5]{y} = 1 - 2x$ $1 - \sqrt[5]{y} = 2x$ $\frac{1-\sqrt[5]{y}}{2} = x$ $f^{-1}(x) = \frac{1 - \sqrt[5]{x}}{2}$
5. Composite function	A **combination** of two or more **functions** to create a new function. $\boldsymbol{fg(x)}$ is the composite function that **substitutes** the function $\boldsymbol{g(x)}$ **into** the function $\boldsymbol{f(x)}$. $\boldsymbol{fg(x)}$ means **'do g first, then f'** $\boldsymbol{gf(x)}$ means **'do f first, then g'**	$f(x) = 5x - 3,\ g(x) = \frac{1}{2}x + 1$ What is $fg(4)$? $g(4) = \frac{1}{2} \times 4 + 1 = 3$ $f(3) = 5 \times 3 - 3 = 12 = fg(4)$ What is $fg(x)$? $fg(x) = 5\left(\frac{1}{2}x + 1\right) - 3 = \frac{5}{2}x + 2$

Topic/Skill	Definition/Tips	Example
1. Square Number	The number you get when you **multiply a number by itself**.	**1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225…** $9^2 = 9 \times 9 = 81$
2. Square Root	The **number you multiply by itself** to get another number. The reverse process of squaring a number.	$\sqrt{36} = 6$ because $6 \times 6 = 36$
3. Solutions to $x^2 = ...$	**Equations** involving **squares** have **two solutions**, one **positive** and one **negative**.	Solve $x^2 = 25$ $x = 5 \text{ or } x = -5$ This can also be written as $x = \pm 5$
4. Cube Number	The number you get when you **multiply a number by itself and itself again**.	1, 8, 27, 64, 125… $2^3 = 2 \times 2 \times 2 = 8$
5. Cube Root	The **number you multiply by itself and itself again** to get another number. The reverse process of cubing a number.	$\sqrt[3]{125} = 5$ because $5 \times 5 \times 5 = 125$
6. Powers of…	The powers of a number are that **number raised to various powers**.	The powers of 3 are: $3^1 = 3$ $3^2 = 9$ $3^3 = 27$ $3^4 = 81$ etc.
7. Multiplication Index Law	When **multiplying** with the same base (number or letter), **add the powers**. $\boldsymbol{a^m \times a^n = a^{m+n}}$	$7^5 \times 7^3 = 7^8$ $a^{12} \times a = a^{13}$ $4x^5 \times 2x^8 = 8x^{13}$
8. Division Index Law	When **dividing** with the same base (number or letter), **subtract the powers**. $\boldsymbol{a^m \div a^n = a^{m-n}}$	$15^7 \div 15^4 = 15^3$ $x^9 \div x^2 = x^7$ $20a^{11} \div 5a^3 = 4a^8$
9. Brackets Index Laws	When raising a power to another power, multiply the powers together. $\boldsymbol{(a^m)^n = a^{mn}}$	$(y^2)^5 = y^{10}$ $(6^3)^4 = 6^{12}$ $(5x^6)^3 = 125x^{18}$
10. Notable Powers	$\boldsymbol{p = p^1}$ $\boldsymbol{p^0 = 1}$	$99999^0 = 1$
11. Negative Powers	A negative power performs the reciprocal. $\boldsymbol{a^{-m} = \frac{1}{a^m}}$	$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$
12. Fractional Powers	The denominator of a fractional power acts as a 'root'. The numerator of a fractional power acts as a normal power. $a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$	$27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2 = 3^2 = 9$ $\left(\frac{25}{16}\right)^{\frac{3}{2}} = \left(\frac{\sqrt{25}}{\sqrt{16}}\right)^3 = \left(\frac{5}{4}\right)^3 = \frac{125}{64}$

Topic/Skill	Definition/Tips	Example
1. Linear Sequence	A number pattern with a **common difference.**	2, 5, 8, 11… is a linear sequence
2. Term	**Each value** in a sequence is called a term.	In the sequence 2, 5, 8, 11…, 8 is the third term of the sequence.
3. Term-to-term rule	A rule which allows you to **find the next term** in a sequence if you **know the previous term.**	First term is 2. Term-to-term rule is 'add 3' Sequence is: 2, 5, 8, 11…
4. nth term	A rule which allows you to **calculate the term** that is in the **nth position** of the sequence. Also known as the 'position-to-term' rule. **n** refers to the **position** of a term in a sequence.	nth term is $3n - 1$ The 100th term is $3 \times 100 - 1 = 299$
5. Finding the nth term of a linear sequence	1. Find the **difference.** 2. **Multiply that by n.** 3. Substitute $n = 1$ to **find out what number you need to add or subtract to get the first number in the sequence.**	Find the nth term of: 3, 7, 11, 15… 1. Difference is +4 2. Start with $4n$ 3. $4 \times 1 = 4$, so we need to subtract 1 to get 3. nth term = $4n - 1$
6. Fibonacci type sequences	A sequence where the next number is found by **adding up the previous two terms**	The Fibonacci sequence is: 1,1,2,3,5,8,13,21,34 ... An example of a Fibonacci-type sequence is: $4, 7, 11, 18, 29$ ...
7. Geometric Sequence	A sequence of numbers where each term is found by **multiplying the previous one** by a number called the **common ratio, r.**	An example of a geometric sequence is: $2, 10, 50, 250$ ... The common ratio is 5 Another example of a geometric sequence is: $81, -27, 9, -3, 1$ ... The common ratio is $-\frac{1}{3}$
8. Quadratic Sequence	A sequence of numbers where the **second difference is constant.** A quadratic sequence will have a n^2 term.	
9. nth term of a geometric sequence	ar^{n-1} where a is the first term and r is the common ratio	The nth term of $2, 10, 50, 250$ .... Is $2 \times 5^{n-1}$

10. nth term of a quadratic sequence	1. Find the first and second differences. 2. Halve the second difference and multiply this by n^2. 3. Substitute $n = 1,2,3,4$ ... into your expression so far. 4. Subtract this set of numbers from the corresponding terms in the sequence from the question. 5. Find the nth term of this set of numbers. 6. Combine the nth terms to find the overall nth term of the quadratic sequence. Substitute values in to check your nth term works for the sequence.	Find the nth term of: 4, 7, 14, 25, 40.. Answer: Second difference = +4 → nth term = $2n^2$ Sequence: 4, 7, 14, 25, 40 $2n^2$ 2, 8, 18, 32, 50 Difference: 2, -1, -4, -7, -10 Nth term of this set of numbers is $-3n + 5$ Overall nth term: $2n^2 - 3n + 5$
11. Triangular numbers	The sequence which comes from a pattern of dots that form a triangle. $1, 3, 6, 10, 15, 21 \ldots$	

Subject: Maths **Topic: Proofs**

Topic/Skill	Definition/Tips	Example
1. Expression	A mathematical statement written using **symbols, numbers** or **letters**,	$3x + 2$ or $5y^2$
2. Equation	A statement showing that **two expressions are equal**	$2y - 17 = 15$
3. Identity	An equation that is **true for all values** of the variables An identity uses the symbol: ≡	$2x \equiv x+x$
4. Formula	Shows the **relationship** between **two or more variables**	Area of a rectangle = length x width or A= LxW
5. Coefficient	A **number** used to **multiply** a **variable**. It is the number that comes before/in front of a letter.	6z 6 is the coefficient z is the variable
6. Odds and Evens	An **even** number is a **multiple of 2** An **odd** number is an integer which is **not a multiple of 2**.	If n is an integer (whole number): An even number can be represented by **2n** or **2m** etc. An odd number can be represented by **2n-1** or **2n+1** or **2m+1** etc.
7. Consecutive Integers	Whole numbers that follow each other in order.	If n is an integer: **n, n+1, n+2** etc. are consecutive integers.
8. Square Terms	A term that is produced by multiply another term by itself.	If n is an integer: n^2, m^2 etc. are square integers
9. Sum	The sum of two or more numbers is the value you get when you add them together.	The sum of 4 and 6 is 10
10. Product	The product of two or more numbers is the value you get when you multiply them together.	The product of 4 and 6 is 24
11. Multiple	To show that an expression is a **multiple** of a number, you need to show that you can **factor out the number**.	$4n^2 + 8n - 12$ is a multiple of 4 because it can be written as: $4(n^2 + 2n - 3)$

Topic: Solving Quadratics by Factorising

Topic/Skill	Definition/Tips	Example
1. Quadratic	A quadratic expression is of the form $$ax^2 + bx + c$$ where a, b and c are numbers, $a \neq 0$	Examples of quadratic expressions: x^2 $8x^2 - 3x + 7$ Examples of non-quadratic expressions: $2x^3 - 5x^2$ $9x - 1$
2. Factorising Quadratics	When a quadratic expression is in the form $x^2 + bx + c$ find the two numbers that **add to give b** and **multiply to give c**.	$x^2 + 7x + 10 = (x + 5)(x + 2)$ (because 5 and 2 add to give 7 and multiply to give 10) $x^2 + 2x - 8 = (x + 4)(x - 2)$ (because +4 and -2 add to give +2 and multiply to give -8)
3. Difference of Two Squares	An expression of the form $a^2 - b^2$ can be factorised to give $(a + b)(a - b)$	$x^2 - 25 = (x + 5)(x - 5)$ $16x^2 - 81 = (4x + 9)(4x - 9)$
4. Solving Quadratics ($ax^2 = b$)	Isolate the x^2 term and square root both sides. Remember there will be a **positive and a negative solution**.	$2x^2 = 98$ $x^2 = 49$ $x = \pm 7$
5. Solving Quadratics ($ax^2 + bx = 0$)	**Factorise** and then **solve = 0**.	$x^2 - 3x = 0$ $x(x - 3) = 0$ $x = 0 \text{ or } x = 3$
6. Solving Quadratics by Factorising ($a = 1$)	**Factorise** the quadratic in the usual way. **Solve = 0** Make sure the equation = 0 before factorising.	Solve $x^2 + 3x - 10 = 0$ Factorise: $(x + 5)(x - 2) = 0$ $x = -5 \text{ or } x = 2$
7. Factorising Quadratics when $a \neq 1$	When a quadratic is in the form $ax^2 + bx + c$ 1. Multiply a by c = ac 2. Find two numbers that add to give b and multiply to give ac. 3. Re-write the quadratic, replacing bx with the two numbers you found. 4. Factorise in pairs – you should get the same bracket twice 5. Write your two brackets – one will be the repeated bracket, the other will be made of the factors outside each of the two brackets.	Factorise $6x^2 + 5x - 4$ 1. $6 \times -4 = -24$ 2. Two numbers that add to give +5 and multiply to give -24 are +8 and -3 3. $6x^2 + 8x - 3x - 4$ 4. Factorise in pairs: $2x(3x + 4) - 1(3x + 4)$ 5. Answer = $(3x + 4)(2x - 1)$
8. Solving Quadratics by Factorising ($a \neq 1$)	**Factorise** the quadratic in the usual way. **Solve = 0** Make sure the equation = 0 before factorising.	Solve $2x^2 + 7x - 4 = 0$ Factorise: $(2x - 1)(x + 4) = 0$ $x = \frac{1}{2} \text{ or } x = -4$

Topic/Skill	Definition/Tips	Example
1. Increase or Decrease by a Percentage	Non-calculator: **Find the percentage** and **add** or **subtract** it from the **original** amount. Calculator: Find the **percentage multiplier** and multiply.	Increase 500 by 20% (Non Calc): 10% of 500 = 50 so 20% of 500 = 100 500 + 100 = 600 Decrease 800 by 17% (Calc): 100%-17%=83% 83% ÷ 100 = 0.83 0.83 x 800 = 664
2. Percentage Multiplier	The **number** you **multiply** a quantity by to **increase or decrease** it by a **percentage**.	The multiplier for increasing by 12% is 1.12 The multiplier for decreasing by 12% is 0.88 The multiplier for increasing by 100% is 2.
3. Reverse Percentage	Find the **correct percentage given in the question**, then work backwards to **find 100%** Look out for words like '**before**' or '**original**'	A jumper was priced at £48.60 after a 10% reduction. Find its original price. 100% - 10% = 90% 90% = £48.60 1% = £0.54 100% = £54
4. Simple Interest	Interest calculated as a **percentage of the original** amount.	£1000 invested for 3 years at 10% simple interest. 10% of £1000 = £100 Interest = $3 \times £100 = £300$

Exam style questions based on 10 most common mistakes questions from GCSE 2018 and November Mock paper:

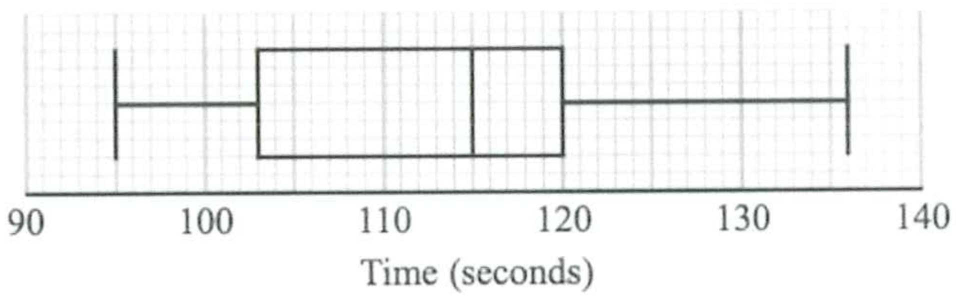
- Box plots
- Circle Theorems
- Algebraic Proof
- Functions
- Rates of Change
- Reverse Percentages
- Area under a Curve
- Index Form/Fractional Powers
- Histograms
- HCF & LCM
- Quadratic Expressions
- Quadratic Sequences

Easter Revision Pack - Higher

Question 1

[Edexcel GCSE Nov2016-1H Q18 Edited]

Tom recorded the times, in seconds, some boys took to complete an obstacle course. He drew this box plot for his results.



Tom also recorded the times some girls took to complete the obstacle course. Here are the times, in seconds, for the girls.

99 101 103 106 108 109 110 110 111 112

113 114 115 115 117 120 124 125 132

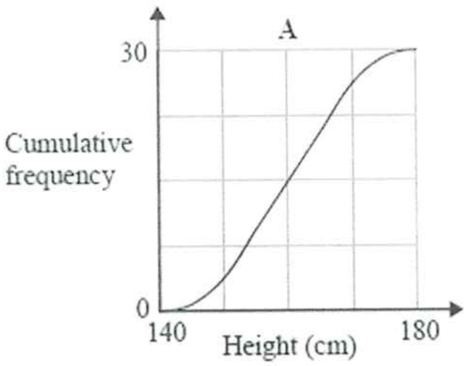
Compare the distribution of the times for the boys with the distribution of the times for the girls.

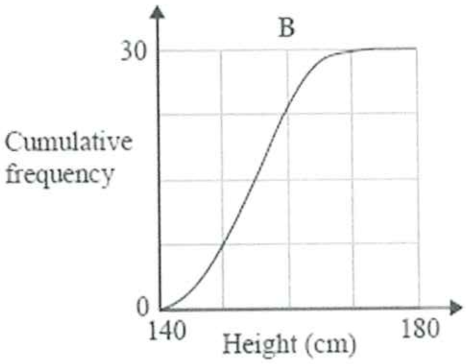
	Boys	Girls
Median	....	....
Range	....	....

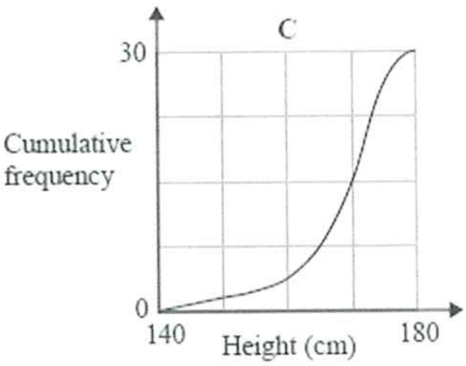
Question 2

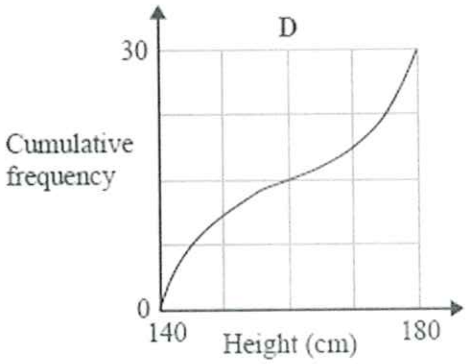
[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 - 1H Q11]

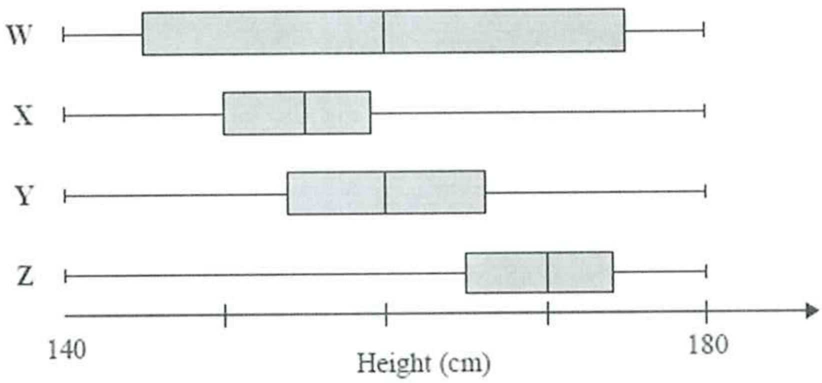
Joan measured the heights of students in four different classes.
She drew a cumulative frequency graph and a box plot for each class.









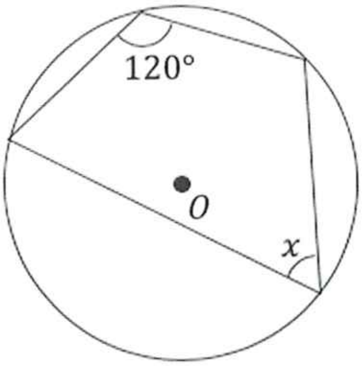


Match each cumulative frequency graph to its box plot.

....

Question 3

O is the centre of the circle.



Which circle theorem would you use to work out the value of x ?

[ ]

[ ]

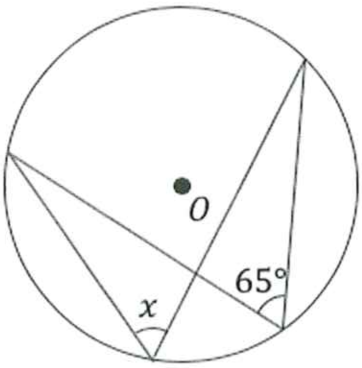
[ ]

[ ] 180°.

[ ]

Question 4

O is the centre of the circle.



Which circle theorem would you use to work out the value of x ?

[ ]

[ ]

[ ]

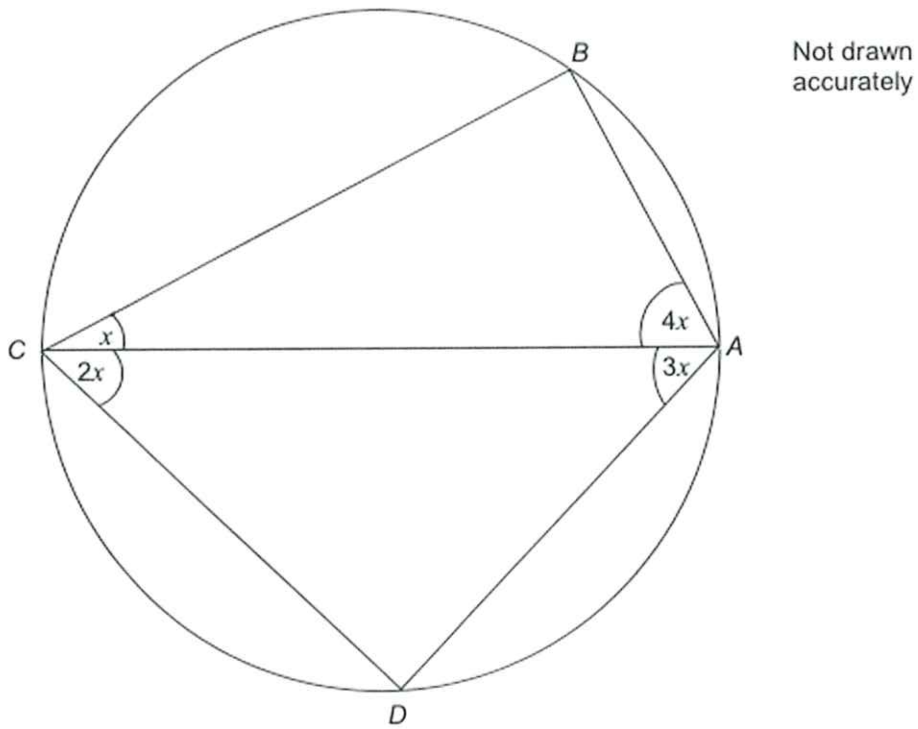
[ ] 180°.

[ ]

Question 5

[AQA IGCSE FM SAM 2020 P1 Q9 Edited]

A , B , C and D are points on a circle. $\angle BCA = x$ $\angle ACD = 2x$ $\angle CAD = 3x$ $\angle CAB = 4x$



Which circle theorem would you use to prove that AC is a diameter of the circle?

[ ]

[ ]

[ ]

[ ]

[ ]

Question 6

Can you put the steps of the proof in the right order to show that if I square any odd number and then divide by 4 I will have a remainder of one?

$$4k^2 + 4k + 1 = 4(k^2 + k) + 1$$

This is one more than a number in the four times table

An odd number can be written in the form $2k + 1$ where k is an integer

When I square this odd number I get $(2k + 1)^2 = 4k^2 + 4k + 1$

Therefore when I divide by four I will have a remainder of 1

....

Question 7

Can you put the steps of the proof in the right order to show that if I add two odd numbers together I will get an even number?

Because k and m are whole numbers, $k + m + 1$ must be a whole number

The other odd number might be different from the first so write this as $2m + 1$ where m is an integer

Adding I get $2k + 1 + 2m + 1 = 2k + 2m + 2$

One odd number can be written in the form $2k + 1$ where k is an integer

$$2k + 2m + 2 = 2(k + m + 1)$$

Therefore $2(k + m + 1)$ is an even number and so the sum of the odd numbers is even

....

Question 8

[Edexcel IGCSE May2014(R)-3H Q11b]

The functions f and g are defined as

$$f(x) = \frac{1}{2}x + 4$$

$$g(x) = \frac{2x}{x + 1}$$

Work out $fg(-3)$.

$fg(-3) =$ ....

Question 9

[Edexcel IGCSE Jan2014(R)-3H Q22b]

The functions f and g are such that $f(x) = x + 3$ and $g(x) = \frac{1}{x-2}$

Express the inverse function g^{-1} in the form $g^{-1}(x) = \ldots$

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

Question 10

[Edexcel IGCSE May2014-3H Q12a]

Helen's savings increased from £155 to £167.40.

Work out the percentage increase in Helen's savings.

.... % increase

Question 11

[Edexcel IGCSE Nov-2010-4H Q11a]

Tom buys a painting for $1350
He sells it for $1269

Work out his percentage loss.

.... %

Question 12

[Edexcel IGCSE Jan2014(R)-3H Q6b]

Renuka sells her car.
She makes a loss of $2162.
Her percentage loss is 23%.

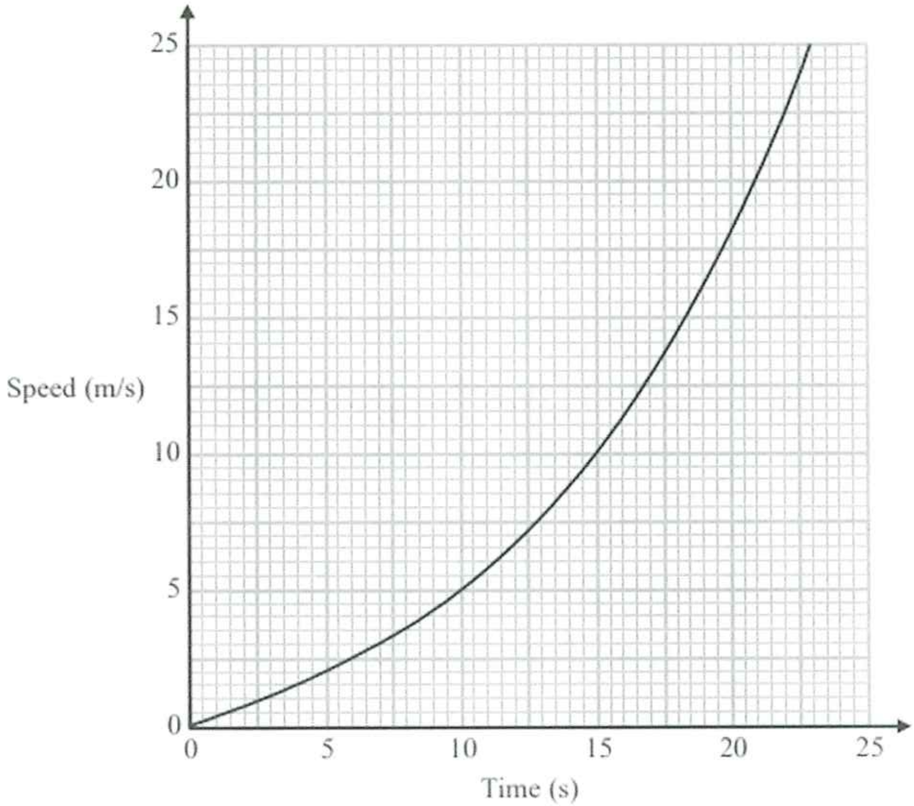
Work out the price for which Renuka sells her car.

$ ....

Question 13

[Edexcel GCSE(9-1) Nov 2017 3H Q18a]

Here is a speed-time graph for a train.



Work out an estimate for the distance the train travelled in the first 20 seconds.

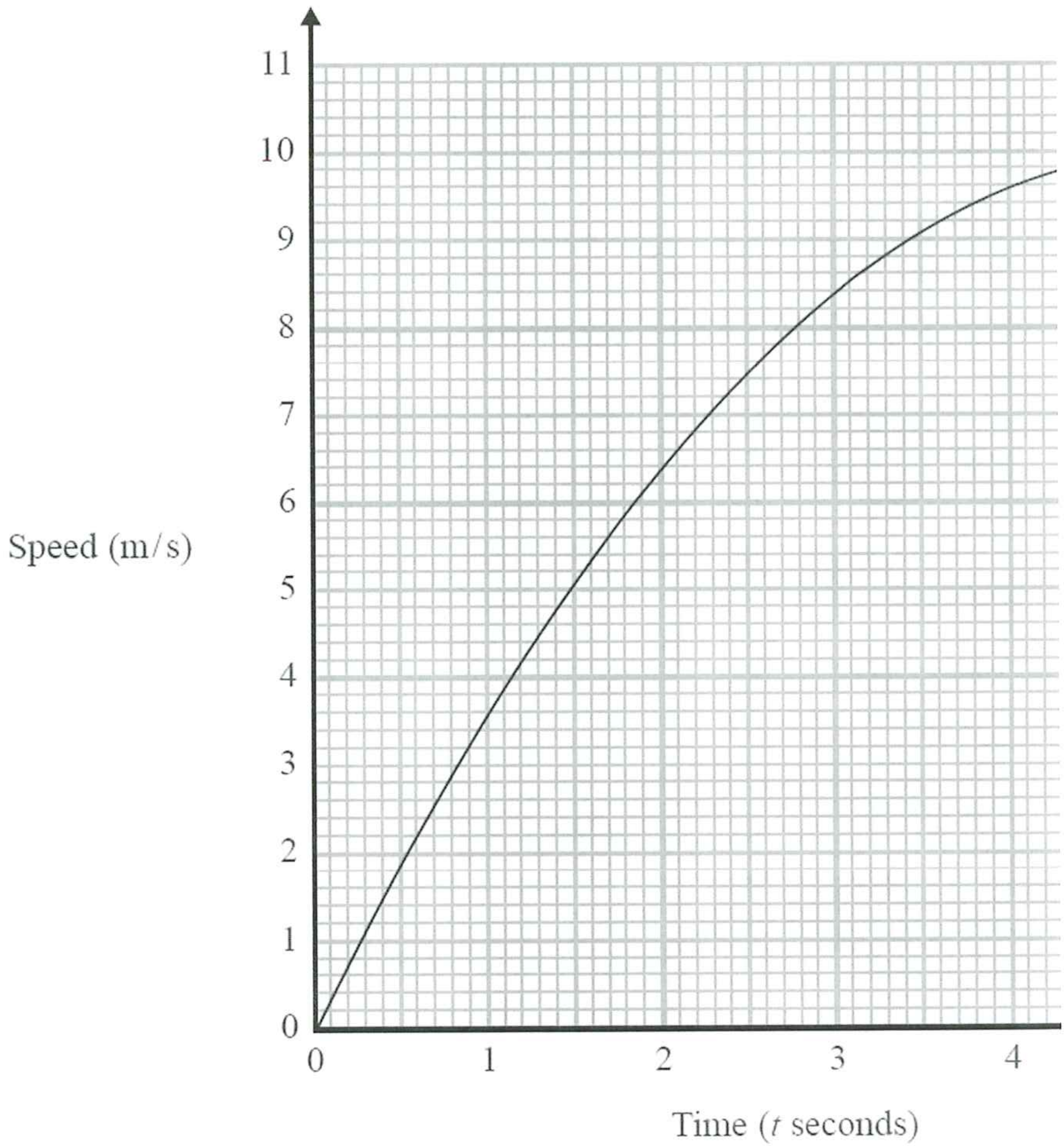
Use 4 strips of equal width.

.... m

Question 14

[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 - 2H Q17a]

Here is a speed-time graph showing the speed, in metres per second, of an object t seconds after it started to move.



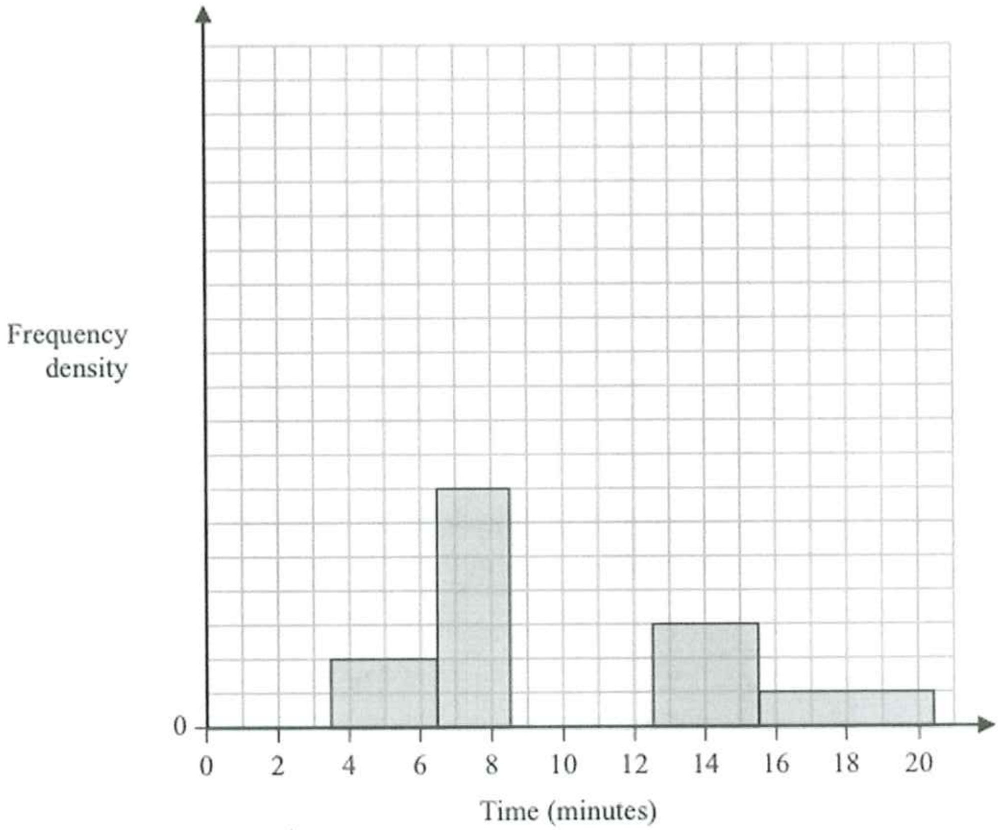
(a) Use 3 strips of equal width to find an estimate for the area under the graph between $t = 1$ and $t = 4$

....

Question 15

[Edexcel AS SAM P2 Q2]

The partially completed histogram and the partially completed table show the time, to the nearest minute, that a random sample of motorists was delayed by roadworks on a stretch of motorway.



Delay (minutes)	Number of motorists
4 – 6	6
7 – 8	
9	17
10 – 12	45
13 – 15	9
16 – 20	

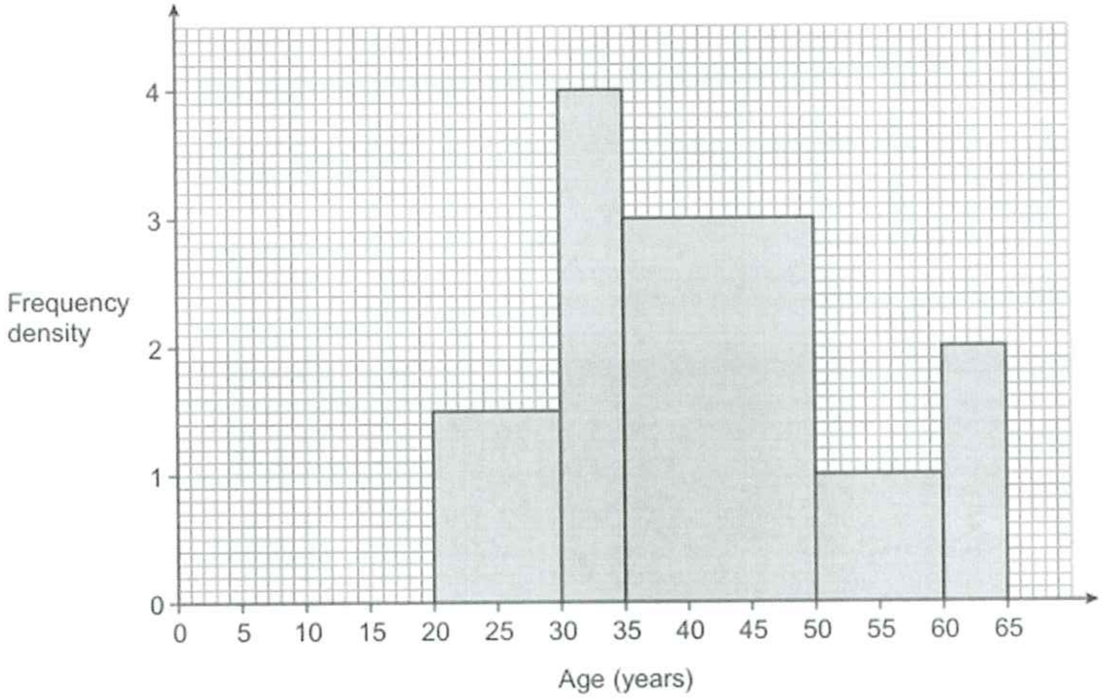
Estimate the percentage of these motorists who were delayed by the roadworks for between 8.5 and 13.5 minutes.

.... %

Question 16

[AQA GCSE June 2014 2H Q24]

The histogram shows information about the ages of 100 employees.



Work out an estimate of the median age of the employees.

.... years

Question 17

[Edexcel IGCSE May2013(R)-4H Q11]

$$A = 2^3 \times 3^2 \times 5^4$$

$$B = 3^5 \times 5 \times 7^3$$

Find the Highest Common Factor (HCF) of A and B .

....

Question 18

[OCR GCSE(9-1) June 2017 3F Q19]

Two numbers have these properties.

Both numbers are greater than 6.

Their highest common factor (HCF) is 6.

Their lowest common multiple (LCM) is 60.

Find the two numbers.

....

....

Question 19

[AQA GCSE June 2013 2F Q19c]

Factorise

$$x^2 - 5x$$

....

Question 20

[OCR GCSE June 2012 4H Q13c]

Factorise and solve.

$$x^2 - 4x - 32 = 0$$

....

Question 21

[KS3 SATs 2006 L6-L8 Paper 1 Q17bii]

Factorise this expression.

$$x^2 - 49$$

....

Question 22

[Edexcel IGCSE(9-1) SAM 2F Q17, SAM 2H Q2]

The first four terms of an arithmetic sequence are

2 9 16 23

Write down an expression, in terms of n , for the n th term.

n th term = ...

Question 23

[AQA GCSE June 2014 2H Q15a]

The n th term of a sequence is $n^2 - 3$

Work out the first three terms of the sequence.

....

....

....

Question 24

[AQA IGCSE FM June2017-P1 Q8]

The first four terms of a quadratic sequence are 10 33 64 103 ...

Work out an expression for the n th term.

n th term = ...

Answers

Question 1

Question 2

"Y", "X", "Z" and "W"

Question 3

180°.

Question 4

Question 5

Question 6

An odd number can be written in the form $2k + 1$ where k is an integer , When I square this odd number I get $(2k+1)^2 = 4k^2 + 4k + 1$, $4k^2 + 4k + 1 = 4(k^2 + k) + 1$, This is one more than a number in the four times table , Therefore when I divide by four I will have a remainder of 1

Question 7

One odd number can be written in the form $2k + 1$ where k is an integer , The other odd number might be different from the first so write this as $2m + 1$ where m is an integer , Adding I get $2k + 1 + 2m + 1 = 2k + 2m + 2$, $2k + 2m + 2 = 2(k + m + 1)$, Because k and m are whole numbers, $k + m + 1$ must be a whole number , Therefore $2(k + m + 1)$ is an even number and so the sum of the odd numbers is even

Question 8

$fg(-3) =$ 5.5

Question 9

$g^{-1}(x) = \frac{2x+1}{x}$

Question 10

8 % increase

Question 11

6 %

Question 12

$ 7238

Question 13

any value in the range 130 m to 132 m

Question 14

21.4

Question 15

67.7 %

Question 16

40 years

Question 17

45

Question 18

12 and 30

Question 19

$x(x-5)$

Question 20

$x = 8$ or $x = -4$

Question 21

$(x-7)(x+7)$

Question 22

n th term = $7n - 5$

Question 23

-2 and 1 and 6

Question 24

n th term = $4n^2 + 11n - 5$

Mixed Practice questions and answers for your Memory Platform Revision.

Test 30

There are **7 questions** in this test. Give yourself **10 minutes** to answer them all.
You may **not** use a calculator for this test.

1. Which of these has the value 1? Circle your answer.

sin 60°   tan 45°   cos 90°   sin 45°

[1]

2. A shape with centre (3, 2) is enlarged by a scale factor of –2 with centre of enlargement (0, 0).
What is the centre of the enlarged shape? Circle your answer.

(4, 6)   (6, 4)   (–4, –6)   (–6, –4)

[1]

3. y is directly proportional to x^3. What is the effect on y when x is doubled?

....
[1]

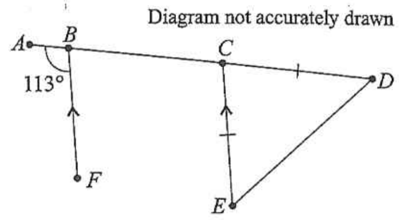
4. Fully simplify the expression $p(p-2)(p+1) + 2p^2\left(p + \frac{1}{p}\right)$.

....
[2]

5. *ABCD* is a straight line.
The triangle *CDE* is isosceles.
The lines *BF* and *CE* are parallel.
The angle $ABF = 113°$.

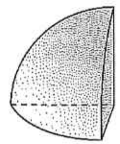
Find the size of the angle *CED*.

Diagram not accurately drawn



.... °
[2]

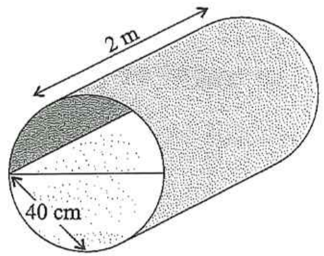
6. The formula for the surface area of a sphere is $4\pi r^2$.
A sphere is cut into eight identical pieces. One of the pieces is shown on the right.
Show that the surface area of each piece of the sphere is $\frac{5}{4}\pi r^2$.



....
[2]

7. A 2 m section of cylindrical pipe is half filled with water.
The distance between the edge of the surface of the water and the deepest point is 40 cm, as shown in the diagram.

Work out the exact volume of water in the section of pipe when it is full. Give your answer in cm³.



.... cm³
[3]

/ 12

Test 31

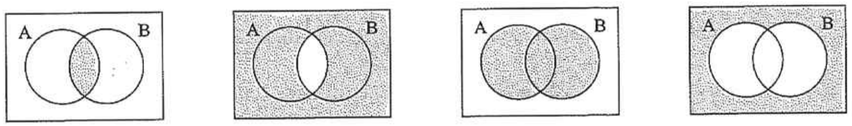
There are **7 questions** in this test. Give yourself **10 minutes** to answer them all.
You may **not** use a calculator for this test.

1. Which of these equations gives the greatest value of y when $x = 1$? Circle your answer.

$y = x^2$ $\quad$ $y = \sin 2x$ $\quad$ $y = 2x$ $\quad$ $y = \frac{x}{2}$

[1]

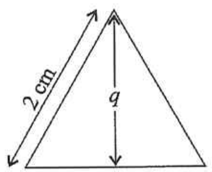
2. Which of the shaded regions shows the complement of $A \cap B$? Circle your answer.



[1]

3. The triangle on the right is equilateral.
Circle the value of the perpendicular height q.

2 cm $\quad$ $\sqrt{2}$ cm $\quad$ $\sqrt{3}$ cm $\quad$ 4 cm



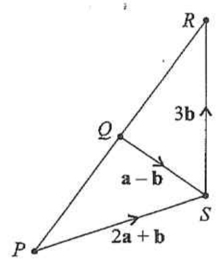
[1]

4. Write $3.\dot{2}$ as an improper fraction in its simplest form. You must show your working.

....

[2]

5. Show that the points P, Q and R form a straight line.



[2]

6. Two security guards are employed to patrol a car park between 20:00 and 06:00.
Exactly one guard is patrolling at all times, and they usually share the time spent doing this in the ratio 2 : 3. One night, the first guard patrols for 30 minutes longer than usual.
In what ratio do they share the patrol time on this night? Give your answer in its simplest form.

....

[2]

7. A sequence is defined by the rule $u_{n+1} = \sqrt{2}u_n + \sqrt{18}$ with $u_1 = -(6 + 3\sqrt{2})$. Show that $u_1 = u_{40}$.

[3]

/ 12

Test 32

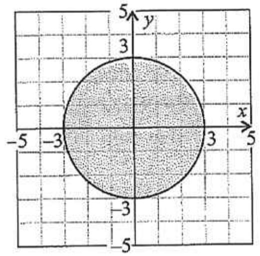
There are **7 questions** in this test. Give yourself **10 minutes** to answer them all.
You may use a calculator for this test.

1. A number, n, is a common multiple of 10 and 16, and also a common factor of 320 and 400. Circle the value of n.

40 80 160 320

[1]

Use the diagram on the right to answer questions 2-3.



2. Circle the inequality that represents the shaded region.

$x^2 + y^2 \leq 3$ $x^2 + y^2 \leq 9$

$x^2 + y^2 \geq 3$ $x^2 + y^2 \geq 9$

[1]

3. The diagram represents a dart board. A dart is thrown at the board and lands at a random position on the grid. What is the probability, to two decimal places, that the dart lands in the shaded region? Circle your answer.

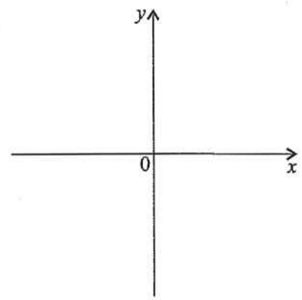
0.25 0.27 0.28 0.38

[1]

4. Farmer Colin has 5.5 km^2 of land and Farmer Gheorghe has 3.2 km^2 of land. Farmer Colin sells 12% of his land and then buys 7% of Farmer Gheorghe's land. How much land does Farmer Colin now own?

.... km^2
[2]

5. Sketch the graph of $y - 3x - 3a = 0$ $(a > 0)$ on the axes on the right. Label the points where the graph intersects the axes with their coordinates.

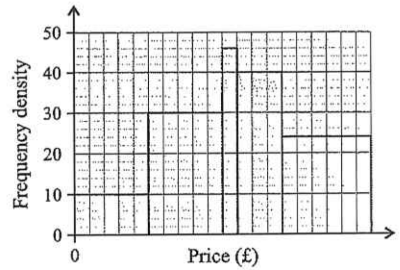


[2]

6. Leona has 10 bags of counters. Each bag contains a square counter, a triangular counter and a circular counter. She picks one counter from each bag. What is the probability that she doesn't pick any square counters? Give your answer to three significant figures.

....
[2]

7. The histogram shows the prices of children's tickets at 255 cinemas. Calculate how many cinemas charged more than £5 for a children's ticket.



....
[3]

/ 12

Test 33

There are **7 questions** in this test. Give yourself **10 minutes** to answer them all.
You may use a calculator for this test.

1. Given that $(x + 2)(x + a) = x^2 - 4$, circle the value of a.

   -2 2 -4 4

   [1]

2. 100 m of a road is covered in rumble strips to warn drivers that they are approaching a roundabout. The ratio of the length of road covered in rumble strips to the entire road is 5 : 12. What length of road is not covered by the rumble strips? Circle your answer.

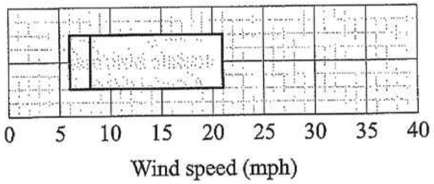
   140 m 240 m 340 m 500 m

   [1]

3. Eamonn measures the wind speed outside his house at midday each day for a month. He begins to draw the box plot below to summarise his results.

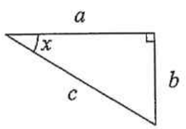
   The range of the wind speeds is 31 mph and the greatest recorded speed was 25 mph faster than the median wind speed.

   Complete the box plot.



   [1]

4. For the triangle below, write down an equation for sin x.



   ....
   [1]

5. A race is held on a school racetrack. The length of the track is 400 m to the nearest metre. Salwa runs the race in 52 seconds, to the nearest second.

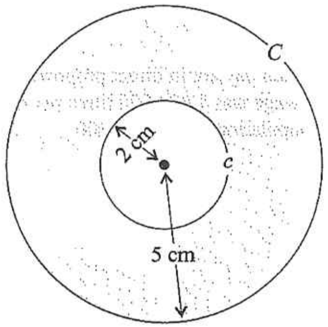
   Calculate the upper bound of Salwa's average speed in the race to two decimal places.

   .... m/s
   [2]

6. The functions f(x) and g(x) are defined by $f(x) = \sqrt{x}$ and $g(x) = x + 2$, where $x \geq 0$. Let $h(x) = fg(x)$. Solve $h^{-1}(x) = 0$. Give your answer in an exact form.

   ....
   [3]

7. C and c are two circles with the same centre. C has radius 5 cm and c has radius 2 cm, as shown in the diagram. The two radii are each increasing at a rate of 40% per second. Find, to two decimal places, the area of the shaded region enclosed by the circles after 10 seconds.



   .... cm^2
   [3]

/12

Test 34

There are **7 questions** in this test. Give yourself **10 minutes** to answer them all.
You may use a calculator for this test.

1. Which of these is an x-intercept of the graph of $y = \cos(x + 3)$? Circle your answer.

(87, 0)   (88, 0)   (92, 0)   (93, 0)

[1]

2. Circle the expression that is equivalent to $\frac{\sqrt{x}}{x^n}$.

x^{1-n} $x^{\frac{1}{2}-n}$ $x^{-\frac{1}{2}n}$ $x^{\frac{1}{n}}$

[1]

3. If $\mathbf{a} = \begin{pmatrix} x \\ -y \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 2x \\ y \end{pmatrix}$, what is $\mathbf{a} + 3\mathbf{b}$? Circle your answer.

$\begin{pmatrix} 3x \\ 0 \end{pmatrix}$ $\begin{pmatrix} 7x \\ 2y \end{pmatrix}$ $\begin{pmatrix} 7x \\ 4y \end{pmatrix}$ $\begin{pmatrix} 5x \\ -2y \end{pmatrix}$

[1]

4. The population of a town and the amount of sewage produced each day are in direct proportion. When the population of the town was 10 000, the amount of sewage was 1 620 000 litres per day. Calculate the amount of sewage produced each day when the population reaches 17 000.

.... litres
[2]

5. The graphs of $y = 5x - 3$ and $y = \frac{1}{ax}$ intersect when $x = 1$. Find the value of a.

a = ...
[2]

6. The number of eggs laid by each of six snakes is given on the right in ascending order. Find the smallest value of e for which the mean is greater than the median.

0	3	5	7	7	e

....
[2]

7. Neptune has a volume of approximately 6.254×10^{13} km^3 and a mass of approximately 1.0243×10^{26} kg. Calculate its average density in g/cm^3 to three significant figures.

.... g/cm^3
[3]

/ 12

Answers

Section One: Number

Test 1 — Pages 2–3

1. $\frac{7}{10} = \frac{21}{30}$, $\frac{23}{30} = \frac{23}{30}$,
   $\frac{5}{6} = \frac{25}{30}$ and $\frac{4}{5} = \frac{24}{30}$
   The largest is $\frac{5}{6}$ *[1 mark]*
2. Height = 81.9 ÷ 4.9
   $\approx 80 \div 5 = 16$ cm *[1 mark]*
3. 1.95×10^{-7} *[1 mark]*
4. $\frac{3}{8} \div 2\frac{1}{5} = \frac{3}{8} \div \frac{11}{5}$ *[1 mark]*
   $= \frac{3}{8} \times \frac{5}{11} = \frac{15}{88}$ *[1 mark]*
5. Minimum mass of one sheet is
   5.1 – 0.05 = 5.05 g *[1 mark]*
   Minimum mass of 100 sheets is
   5.05 × 100 = 505 g *[1 mark]*
6. Prime factors common to all three numbers are 5^2 and 13, so HCF = $5^2 \times 13$
   [1 mark for a correct method, 1 mark for the correct answer]
7. Let $r = 0.4\dot{5}$, then $100r = 45.4\dot{5}$.
   $99r = 45.4\dot{5} - 0.4\dot{5} = 45$
   $r = \frac{45}{99} = \frac{5}{11}$ *[1 mark]* so each fish gets $\frac{5}{11}$ g of food. Number of fish
   $= 20 \div \frac{5}{11}$ *[1 mark]* $= 20 \times \frac{11}{5}$
   $= 44$ *[1 mark]*

Test 2 — Pages 4–5

1. $125\% = 1.25 = 1\frac{1}{4}$ so 125% is not equivalent to one eighth. *[1 mark]*
2. $9 \times 10^7 + 8 \times 10^6 = (9 + 0.8) \times 10^7$
   $= 9.8 \times 10^7$ *[1 mark]*
3. $\frac{6 \times 8 + 4}{\sqrt{18 - 6 \div 3}} = \frac{48 + 4}{\sqrt{18 - 2}} = \frac{52}{\sqrt{16}}$
   $= \frac{52}{4} = 13$ *[1 mark]*
4. $280 = 28 \times 10 = 4 \times 7 \times 2 \times 5$
   $= 2 \times 2 \times 7 \times 2 \times 5 = 2^3 \times 5 \times 7$
   [1 mark for a correct method, 1 mark for the correct answer]
5. $\frac{8}{9} + \frac{5}{12} = \frac{32}{36} + \frac{15}{36}$ *[1 mark]*
   $= \frac{47}{36} = 1\frac{11}{36}$ *[1 mark]*

(continued)

6. Upper bound of side length
   = 1 + 0.5 = 1.5 cm *[1 mark]*
   So upper bound of area
   = 1.5 × 1.5 = 2.25 cm² *[1 mark]*
7. The factors of 10 are 1, 2, 5 and 10. The HCF must be one of these numbers, so the LCM must be 14, 28, 70 or 140. *[1 mark]*
   14 and 28 are less than 30, so the HCF and LCM must be either (5 and 70) or (10 and 140). So her dad's age must be a multiple of 5. *[1 mark]*
   The multiples of 5 in the range given are 30, 35 and 40. The only option that is a factor of 70 or 140 is 35, so he is 35 years old. *[1 mark]*

Test 3 — Pages 6–7

1. 4.3×10^{-18} *[1 mark]*
2. Factors of 42: 1, 2, 3, 6, 7, 14, 21, 42
   Factors of 56: 1, 2, 4, 7, 8, 14, 28, 56
   Common factors: 1, 2, 7 and 14
   So four common factors *[1 mark]*
3. $4.97 \times 2.19^3 \approx 5 \times 2^3$
   $= 5 \times 8 = 40$ *[1 mark]*
4. The possible numbers are 60, 71, 82 and 93. 60 and 82 are even, and 93 is divisible by 3, but 71 is prime so Fran's number must be 71. *[1 mark]*
5. $30 \overline{)7\ 9\ {}^{19}0\ {}^{10}0\ {}^{10}0}$ with quotient $2.6\ 3\ 3\ldots$ So $2.6\dot{3}$
   [1 mark for a correct method, 1 mark for the correct answer]
6. Space taken up by music and pictures
   $= \frac{2}{9} + \frac{1}{6} = \frac{4}{18} + \frac{3}{18} = \frac{7}{18}$ *[1 mark]*
   So space taken up by videos
   $= 1 - \frac{7}{18} = \frac{11}{18}$.
   $\frac{11}{18}$ of 2 GB $= 2 \times \frac{11}{18}$ *[1 mark]*
   $= \frac{11}{9} = 1\frac{2}{9}$ GB *[1 mark]*
7. Upper bound of A = 15.25 *[1 mark]*
   Lower bound of B = 0.25 *[1 mark]*
   So maximum value of $\frac{A}{2B}$ is
   $\frac{15.25}{2 \times 0.25} = \frac{15.25}{0.5}$
   = 15.25 × 2 = 30.5 *[1 mark]*

Test 4 — Pages 8–9

1. $\frac{99}{100} = 0.99$, $9.9 = 9.9$
   $99.9\% = 0.999$, $1\frac{9}{10} = 1.9$
   So the largest is 9.9 *[1 mark]*
2. $2.5 = \frac{5}{2}$
   Reciprocal of $\frac{5}{2}$ is $\frac{2}{5} = 0.4$ *[1 mark]*
3. 0.8435 rounds down to 0.8 to 1 s.f. Dividing by this smaller number will make the answer larger, meaning it will be an overestimate. *[1 mark]*
4. $\frac{0.48 \times 3.5^2}{5 - \sqrt{6.8 \div 2.1}} = 1.8371...$ *[1 mark]*
   = 1.84 (2 d.p.) *[1 mark]*
5. $z + 1$ is a positive cube number less than 101, i.e. either 1, 8, 27 or 64. So z is either 7, 26 or 63.
   You can ignore z + 1 = 1 since this gives z = 0 and the question says z > 0.
   Of these, only 26 is one more than a square number (25), so $z = 26$.
   [1 mark for a correct method, 1 mark for the correct answer]
6. The proportion that is water is
   $\frac{1.4 \times 10^{21}}{6.0 \times 10^{24}} = \frac{7}{30\,000}$ *[1 mark]*
   So the proportion that is not water is
   $1 - \frac{7}{30\,000} = \frac{29\,993}{30\,000}$ *[1 mark]*.
7. The prime factorisation of b contains 2^5, as the LCM contains 2^5 and the prime factorisation of a does not. *[1 mark]*
   Prime factorisation of b contains 3^2, as the HCF of a and b contains 3^2. *[1 mark]*
   So $b = 2^5 \times 3^2 = 288$ *[1 mark]*

Section Two: Algebra

Test 5 — Pages 10–11

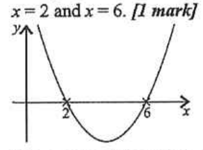
1. $\frac{1}{\sqrt{5}}$ *[1 mark]*
2. The differences are 4, 6, 8, 10, ... The difference between these differences is 2. So the coefficient of n^2 is 2 ÷ 2 = 1. Then the formula must be $n^2 + n + 2$ *[1 mark]*.
   You could also try different values of n in the formulas to see which formula generates the correct sequence.

3. $(x - 1)^2 = 0 \Rightarrow x - 1 = 0$
   $\Rightarrow x = 1$ *[1 mark]*
4. $\sqrt{72} = \sqrt{36}\sqrt{2} = 6\sqrt{2}$ *[1 mark]*
5. At $x = 1$: $5 - 2(1)^3 - (1)^2 = 2$
   At $x = 2$: $5 - 2(2)^3 - (2)^2 = -15$
   There is a sign change so a solution lies between 1 and 2.
   [1 mark for evaluating the cubic at 1 and 2, 1 mark for commenting on the sign change]
6. $\frac{2p - 16}{p^2 - 64} = \frac{2(p - 8)}{(p + 8)(p - 8)} = \frac{2}{p + 8}$
   [1 mark for factorising numerator, 1 mark for factorising denominator, 1 mark for the correct answer]
7. $2x + y = 5 \xrightarrow{\times 2} 4x + 2y = 10$
   $x - 3y = 2 \xrightarrow{\times 5} 5x - 15y = 10$
   $5x - 15y = 10$
   $-\ 4x + 2y = 10$
   $x - 17y = 0$ so $x = 17y$
   [1 mark for scaling the equations, 1 mark for eliminating the constant or a variable, 1 mark for a fully correct argument to show the result]
   You could have done this by solving the equations. You'll get x = ¹⁷/₇ and y = ¹/₇ so x = 17 × y = 17y.

Test 6 — Pages 12-13

1. $f = 5b + 100$ *[1 mark]*
2. $a = 1$, $b = -4$ and $c = 2$
   $x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4 \times 1 \times 2}}{2 \times 1}$
   $x = \frac{4 \pm \sqrt{16 - 8}}{2}$ *[1 mark]*
3. $(y + 5)(y - 5)$ *[1 mark]*
4. $f(36) = \frac{6}{5\sqrt{36}} = \frac{6}{5 \times 6} = \frac{1}{5}$ *[1 mark]*
5. $d = \frac{3s(1 - v)L^2}{Et^2}$
   $\Rightarrow dEt^2 = 3s(1 - v)L^2$ *[1 mark]*
   $\Rightarrow \frac{dEt^2}{3sL^2} = 1 - v$
   $\Rightarrow v = 1 - \frac{dEt^2}{3sL^2}$ *[1 mark]*
6. $(x + 1)(x - 3)(x - 5)$
   $= (x^2 - 2x - 3)(x - 5)$
   $= x^3 - 5x^2 - 2x^2 + 10x - 3x + 15$
   $= x^3 - 7x^2 + 7x + 15$
   [1 mark for multiplying any two brackets together, 1 mark for a correct method to multiply the result by the third bracket, 1 mark for the correct answer]

7. $100 - 8x < 88 - x^2$
   $x^2 - 8x + 12 < 0$ *[1 mark]*
   $(x - 6)(x - 2) < 0$
   The graph of $x^2 - 8x + 12 = 0$ is u-shaped and crosses the x-axis at $x = 2$ and $x = 6$. *[1 mark]*



   The graph is below 0 when $2 < x < 6$. So the possible values of x are 3, 4 and 5. *[1 mark]*

Test 7 — Pages 14-15

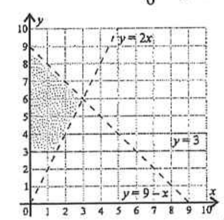
1. $(x - 4)(x + 3) = 0$ *[1 mark]*
2. $x^3 - y = 9 \Rightarrow x^3 = 9 + y$
   $\Rightarrow x = \sqrt[3]{9 + y}$ *[1 mark]*
3. Volume of cylinder = $\pi r^2 h$
   $= \pi(c + 2)^2(c - 1)$ mm³ *[1 mark]*
4. $u_2 = 3 \times 12 - 6 = 30$ *[1 mark]*
   $u_3 = 3 \times 30 - 6 = 84$ *[1 mark]*
5. $5(x - 4) = \frac{3x}{2} + 1$
   $\Rightarrow 10(x - 4) = 3x + 2$
   $\Rightarrow 10x - 40 = 3x + 2$ *[1 mark]*
   $\Rightarrow 7x = 42 \Rightarrow x = 6$ *[1 mark]*
6. $\frac{1}{u} \times \sqrt[3]{u} = u^{-1} \times u^{\frac{1}{3}}$ *[1 mark]*
   $= u^{-1+\frac{1}{3}} = u^{-\frac{2}{3}}$ *[1 mark]*
7. Complete the square:
   $(x + 3)^2 = x^2 + 6x + 9$
   Then $x^2 + 6x + 12 = (x^2 + 6x + 9) + 3$
   $= (x + 3)^2 + 3$
   The line of symmetry goes through the turning point, which occurs when the brackets are 0. This is when $x = -3$, so the equation of the line of symmetry is $x = -3$.
   [1 mark for a correct method to find the turning point, 1 mark for finding the turning point, 1 mark for the correct line of symmetry]

Test 8 — Pages 16-17

1. $2p + 3q = 20$
   $10p - 5q = 60$ *[1 mark]*
2. The turning point occurs when the brackets are 0. This is when $x = 7$ and $y = -2$, so $(7, -2)$ *[1 mark]*.

3. Let $x = f(y)$, so $x = \sqrt{y + 4}$
   $\Rightarrow x^2 = y + 4 \Rightarrow y = x^2 - 4$
   So $f^{-1}(x) = x^2 - 4$ *[1 mark]*
4. $-4x \geq 12 \Rightarrow -x \geq 3$
   $\Rightarrow x \leq -3$ *[1 mark]*
   Don't forget that you need to change ≥ to ≤ when you swap the sign over.
5. If a and b are square numbers then $a = c^2$ and $b = d^2$ for some integers c and d. *[1 mark]*
   Then $ab = c^2d^2 = (cd)^2$, which is a square number. *[1 mark]*
6. $x_0 = -0.5$ $x_4 = -0.8341...$
   $x_1 = -0.9085...$ $x_5 = -0.8353...$
   $x_2 = -0.8171...$ $x_6 = -0.8350...$
   $x_3 = -0.8393...$
   $x_5 = x_6$ to 3 d.p. so
   $x = -0.835$ to 3 d.p.
   [1 mark for carrying out the first iteration correctly, 1 mark for goin at least as far as x_6, 1 mark for the correct value of x]
7. The stone lands when $h = 0$ so solv the quadratic:
   $a = -5$, $b = 3$ and $c = 4$
   $t = \frac{-3 \pm \sqrt{3^2 - 4 \times -5 \times 4}}{2 \times -5}$ *[1 mar]*
   $= \frac{-3 \pm \sqrt{89}}{-10}$
   $t = -0.6433...$, $1.2433...$ *[1 mark]*
   But time cannot be negative so the stone lands after $t = 1.24$ seconds (3 s.f.) *[1 mark]*.

Test 9 — Pages 18-19

1. $\sqrt{3}(\sqrt{3} + \sqrt{3}) = 3 + 3 = 6$ *[1 mark*
2. $\frac{x}{2} + \frac{x + 1}{6} = \frac{3x}{6} + \frac{x + 1}{6}$
   $= \frac{4x + 1}{6}$ *[1 mark]*
3. 

   [1 mar

4. $2x^2 - x = 15 \Rightarrow 2x^2 - x - 15 = 0$
$\Rightarrow (2x+5)(x-3) = 0$
[1 mark for the correct numbers in the brackets, 1 mark for the correct signs]

5. $fg(x) = f(x(x-12))$
$= 2 + x(x-12)$ ***[1 mark]***
$= x^2 - 12x + 2$ ***[1 mark]***

6. $0 = (x-4)^2 - 3 \Rightarrow (x-4)^2 = 3$
$\Rightarrow x - 4 = \pm\sqrt{3} \Rightarrow x = 4 \pm \sqrt{3}$
So the coordinates are $(4+\sqrt{3}, 0)$ and $(4-\sqrt{3}, 0)$.
[1 mark for attempting to solve the equation, 1 mark for the correct coordinates]

7. $3n+2$ and $3(n+1)+2$ are consecutive terms. Their sum is:
$(3n+2) + (3(n+1)+2)$ ***[1 mark]***
$= 3n + 2 + 3n + 3 + 2$
$= 6n + 7$ ***[1 mark]***
$= 6(n+1) + 1 = 6x + 1$
The multiples of 6 are numbers of the form $6x$, and 1 more than a multiple of 6 is never a multiple of 6. So a number of the form $6x+1$ is not divisible by 6 ***[1 mark]***.

Test 10 — Pages 20-21

1. $(bc)^2 = a \Rightarrow bc = \pm\sqrt{a}$
$\Rightarrow c = \frac{\pm\sqrt{a}}{b}$ ***[1 mark]***

2. $(2p)^2 \equiv 4q^2$ ***[1 mark]***
It's only true for certain values of p and q so the identity symbol is incorrect.

3. $\frac{5x}{12} = 30 \Rightarrow 5x = 360$
$\Rightarrow x = 72$ ***[1 mark]***

4. $4g^2 - 9 = (2g)^2 - 3^2$
$= (2g+3)(2g-3)$
[2 marks for the correct factorisation, otherwise 1 mark for attempting to use the difference of two squares]

5. The common difference is 6 so the nth term formula will include $6n$. For $n = 1$, $6n = 6$ so add 9 to get 15. The nth term is $6n + 9$ ***[1 mark]***.
When $n = 500$, $6 \times 500 + 9$
$= 3000 + 9 = 3009$ ***[1 mark]***

6. $\frac{4}{2+\sqrt{6}}$
$= \frac{4(2-\sqrt{6})}{(2+\sqrt{6})(2-\sqrt{6})}$ ***[1 mark]***
$= \frac{8-4\sqrt{6}}{4-6} = \frac{8-4\sqrt{6}}{-2}$
$= -4 + 2\sqrt{6}$ ***[1 mark]***

7. Rodrick takes $31 + (60 + p) + 4p$
$= 91 + 5p$ minutes ***[1 mark]***.
2 hours and 16 mins = 136 mins, so $136 \le 91 + 5p$ ***[1 mark]*** $\Rightarrow 45 \le 5p$
$\Rightarrow p \ge 9$ so the lowest value of p is 9 ***[1 mark]***.

Section Three: Graphs

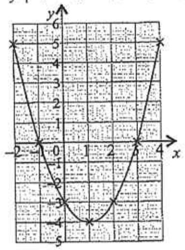
Test 11 — Pages 22–23

1. $y = 3^x$ ***[1 mark]***
2. $f(x-2)$ is a translation of $f(x)$ by two units to the right, so the answer is C ***[1 mark]***.
3. Reading the point of intersection off the graph gives $t = 90$ ns ***[1 mark]***
4. k is the y-intercept, which, from the diagram, is 8. ***[1 mark]***
5. The line of symmetry will be halfway between the two points where the graph crosses the x-axis, i.e. at $x = \frac{(-4)+2}{2} = \frac{-2}{2} = -1$
So the line has equation $x = -1$.
[1 mark for a correct method, 1 mark for the correct answer]
6. At A, $x = 0$ so $y = 10 - 2(0) = 10$, so A is at $(0, 10)$ ***[1 mark]***
At B, $y = 0$ so $10 - 2x = 0$
$\Rightarrow 2x = 10 \Rightarrow x = 5$
so B is at $(5, 0)$ ***[1 mark]***
7. $AC : BC = 4 : 1$, so C is $\frac{4}{5}$ of the way from (0, 10) to (5, 0).
So C is at (4, 2) ***[1 mark]***
The gradient of $y = 10 - 2x$ is -2, so the gradient of the perpendicular line is $\frac{-1}{-2} = \frac{1}{2}$ ***[1 mark]***
The perpendicular has the equation $y = \frac{1}{2}x + c$ and goes through (4, 2).
Substitute in (4, 2):
$2 = \frac{1}{2}(4) + c \Rightarrow 2 = 2 + c$
$\Rightarrow c = 0$ ***[1 mark]***
So the y-intercept is 0, meaning the line goes through the origin ***[1 mark]***

Test 12 — Pages 24–25

1. cubic ***[1 mark]***
2. Gradient $= \frac{\text{change in } y}{\text{change in } x}$
$= \frac{8-18}{6-4} = \frac{-10}{2} = -5$ ***[1 mark]***
3. Armin travelled 100 m in 14 seconds, so his average speed was:
$100 \div 14 = 7.14$ m/s (2 d.p.) ***[1 mark]***
4. The runner who fell over was Silvio.
The horizontal section of his graph, between 6 seconds and 10 seconds, shows that he wasn't moving then.
He had a total race time of 16 seconds and $10 - 6 = 4$ seconds of that was stationary. ***[1 mark]***
$(4 \div 16) \times 100 = 25\%$ ***[1 mark]***
5. Using a table of values:

x	−2	−1	0	1	2	3	4
y	5	0	−3	−4	−3	0	5

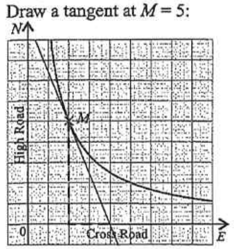


[1 mark for the correct values, 1 mark for an accurate graph]

6. $x^2 - x - 2 = 0$
$\Rightarrow x^2 - x(-x) - 2(-1) = -x - 1$
$\Rightarrow x^2 - 2x - 3 = -x - 1$ so you would need to plot the line $y = -x - 1$
[1 mark for a correct method, 1 mark for the correct answer]
7. The graph is a circle centred at the origin, so the equation is of the form $x^2 + y^2 = r^2$ ***[1 mark]***
Substitute in the point (4, 7):
$4^2 + 7^2 = r^2$
$\Rightarrow r^2 = 16 + 49$ ***[1 mark]*** $= 65$
The equation is $x^2 + y^2 = 65$ ***[1 mark]***

Test 13 — Pages 26–27

1. The velocity is increasing with time, so it is speeding up. ***[1 mark]***
2. Distance travelled = area under a velocity-time graph. Using the formula for the area of a trapezium:
Distance $= \frac{1}{2}(7+2) \times 6$
$= \frac{1}{2} \times 9 \times 6 = 27$ m ***[1 mark]***
3. $f(x) = \cos x°$ ***[1 mark]***
4. Using the symmetry of the graph, the other solution is at
$x = 360 - 53.1 = 306.9$
[1 mark for a correct method, 1 mark for the correct answer]
5. Pick a point that lies on the line, e.g. $E = 5$ and $N = 2$ ***[1 mark]***
$2 = \frac{a}{5} \Rightarrow a = 10$ ***[1 mark]***
6. Draw a tangent at $M = 5$:



Pick a point on your tangent, e.g. the tangent passes through (4, 0) and $M(2, 5)$, so the gradient is $\frac{5-0}{2-4} = -\frac{5}{2}$ or -2.5
[1 mark for a correct method, 1 mark for a gradient between −3 and −2]
7. The perpendicular line has a gradient of $-1 \div -\frac{5}{2} = \frac{2}{5}$ or 0.4 ***[1 mark]***
So the equation of the line is
$N = 0.4E + c$
The line passes through (2, 5), so:
$5 = 0.4(2) + c \Rightarrow 5 = 0.8 + c$
$\Rightarrow c = 4.2$ ***[1 mark]***
so the line is $N = 0.4E + 4.2$
When she gets to High Road, $E = 0$, so $N = 0.4(0) + 4.2 = 4.2$. So she is 4.2 miles north of Cross Road ***[1 mark]***
If your answer to Q6 was between −3 and −2 then your answer to Q7 should be somewhere between 4 and 4.3.

Section Four: Ratio, Proportion and Rates of Change

Test 14 — Pages 28–29

1. $2.1 : 9 \overset{\times 10}{=} 21 : 90 \overset{\div 3}{=} 7 : 30$ ***[1 mark]***
2. $x = \frac{k}{\sqrt[3]{y}}$ ***[1 mark]***
3. 16 days = 8 days × 2, so
6 × 2 = 12 batteries are needed to power 12 machines for 16 days.
So 12 ÷ 3 = 4 machines will need 12 ÷ 3 = 4 batteries. ***[1 mark]***
4. 375 000 litres
$= (375\,000 \times 1000)$ cm³
$= 375\,000\,000$ cm³ ***[1 mark]***
5. 10% of 10 000 = 1000
Shells remaining after one year
= 10 000 − 1000 = 9000
10% of 9000 = 900
Shells remaining after two years
= 9000 − 900 = 8100
[1 mark for a correct method, 1 mark for the correct answer]
6. Area of trapezium $= \frac{1}{2}(3+5) \times h$
$= 4h$ cm² ***[1 mark]***
Area of rectangle $= 5 \times h = 5h$ cm²
$5h : 4h = 5 : 4$ ***[1 mark]***
7. Area of flat end $= \pi \times 1^2 = \pi$ cm²
Pressure at flat end $= \frac{F}{\pi}$ N/cm²
Area of sharp end $= (\pi \times 0.1^2)$ mm²
$= (\pi \times 0.01^2)$ cm² $= 0.0001\pi$ cm²
Pressure at sharp end
$= \frac{F}{0.0001\pi}$ N/cm² $= \frac{10\,000F}{\pi}$ N/cm²
Difference $= \frac{10\,000F}{\pi} - \frac{F}{\pi}$
$= \frac{9999F}{\pi}$ N/cm²
[1 mark for a correct area, 1 mark for a correct pressure, 1 mark for both correct pressures with the same units, 1 mark for the difference]

Test 15 — Pages 30–31

1. 1 N/m² ***[1 mark]***
2. $2^3 = 8$ m³ $= (8 \times 1000^3)$ mm³
$= (8 \times 1\,000\,000\,000)$
$= 8\,000\,000\,000$ mm³ ***[1 mark]***
3. This is an increase of £30 and $\frac{30}{40} = \frac{3}{4} = 0.75$, so 75% ***[1 mark]***.
4. $4\frac{1}{3} : 1 = \frac{13}{3} : 1 = 13 : 3$ ***[1 mark]***

5. $a = \frac{R}{b}$ ***[1 mark]*** a is inversely proportional to b ***[1 mark]***
6. There are 6 + 7 = 13 parts in total ***[1 mark]***. $91 \times \frac{6}{13} = 42$ ***[1 mark]***
50% of 42 = 42 ÷ 2 = 21
25% of 42 = 21 ÷ 2 = 10.5
12.5% of 42 = 10.5 ÷ 2
= 5.25 gallons ***[1 mark]***
7. $\frac{4}{5}$ is the garden and $\frac{1}{5}$ is woodland.
$\frac{3}{4}$ of the garden is closed.
$\frac{9}{10}$ of the woodland is closed.
Closed garden:
$\frac{3}{4} \times \frac{4}{5} = \frac{3}{5} = 60\%$ ***[1 mark]***
Closed Woodland:
$\frac{9}{10} \times \frac{1}{5} = \frac{9}{50} = 18\%$ ***[1 mark]***
So 60% + 18% = 78% of the entire grounds is closed ***[1 mark]***.

Test 16 — Pages 32–33

1. 5 + 9 = 14 parts and 5 are element f so $\frac{5}{14}$ is element f. ***[1 mark]***
2. $\frac{25}{40} = \frac{12.5}{20} = \frac{62.5}{100} = 62.5\%$ ***[1 mark]***
3. $5x$ parcels could be delivered by y vans in $5z$ hours. So $3y$ vans would take $5z \div 3 = \frac{5z}{3}$ hours. ***[1 mark]***
4. $D = 100\,000 \times 0.94^{24}$ ***[1 mark]***
5. $t = 441\,000 \div 200\,000$ ***[1 mark]***
$= 2.205$ ***[1 mark]***
6. From the fraction, $2a : b = 4 : 13$, so $a : b = 2 : 13$ ***[1 mark]***
$a + b = 2 + 13 = 15$ parts in total.
Scaling up the second ratio gives $6c : a + b = 4 : 5 = 12 : 15$ ***[1 mark]***.
Therefore, $a : b : 6c = 2 : 13 : 12$
so $a : b : c = 2 : 13 : 2$ ***[1 mark]***.
7. Pressure = force ÷ area, so area of triangular face
= force ÷ pressure = 480 ÷ 1.6
= 4800 ÷ 16 = 300 cm² ***[1 mark]***
So $300 = \frac{1}{2} \times$ base × height
$300 = \frac{1}{2} \times \sqrt{400} \times h$ ***[1 mark]***
$300 = 10h \Rightarrow h = 30$ cm ***[1 mark]***

Test 17 — Pages 34–35

1. 3 + 8 = 11 parts, 3 of which are vegan. So $\frac{3}{11}$ are vegan ***[1 mark]***.

2. $13\text{ km}^2 = (13 \times 1000^2)\text{ m}^2$
$= (13 \times 1\,000\,000)\text{ m}^2$
$= 13\,000\,000\text{ m}^2$ *[1 mark]*
3. $3:8$ so $1:\frac{8}{3}$ or $1:2.\dot{6}$ *[1 mark]*
4. Density = mass ÷ volume, so
mass = density × volume
$= 0.0005 \times 1\,000\,000\,000$
$= 500\,000$ kg *[1 mark]*
5. $1.1 \times \frac{x}{y} = 2x$ *[1 mark]*
$y = 1.1 \times \frac{x}{2x} = 1.1 \times \frac{1}{2}$
$= 0.55$ *[1 mark]*
6. $230 = 160 \times \text{multiplier}^3$ *[1 mark]*
multiplier $= \sqrt[3]{230 \div 160}$
$= 1.1285...$ *[1 mark]*. So her harvest is increasing by $(1.1285... - 1) \times 100$
$= 12.9\%$ (1 d.p.) each year. *[1 mark]*
7. Pressure = force ÷ area, so
area of circular face
$= 523\,676 \div 261\,838 = 2\text{ m}^2$ *[1 mark]*
Volume $= 2 \times 3 = 6\text{ m}^3$ *[1 mark]*
Density = mass ÷ volume
$= 53\,400 \div 6 = 8900\text{ kg/m}^3$
So the cylinder is copper. *[1 mark]*

Test 18 — Pages 36–37

1. 50% increase of cashew nuts
$= 4 \times 1.5 = 6$. So the ratio becomes
$5:6$ *[1 mark]*
2. $1999.99 \times 0.65 = £1299.9935$
$= £1299.99$ (nearest penny) *[1 mark]*
3. $1\text{ m} = 100\text{ cm} \approx (100 \div 30)$ ft
$= 3.33$ ft (2 d.p.) *[1 mark]*
4. Original number of shoppers:
$28\,000\,000 \div 1.12$
$= 25\,000\,000$ *[1 mark]*
17% increase: $25\,000\,000 \times 1.17$
$= 29\,250\,000$ *[1 mark]*
5. First distance $= 750 \times \frac{40}{60} = 500$ km
Second distance $= 900 \times \frac{50}{60} = 750$ km
Total distance = 1250 km
[1 mark for one of the distances correct, 1 mark for the correct final answer]
The times were given in minutes so you need to convert them into hours first.
6. Let u be the amount Uma paid.
$2500 = u \times 1.05^{80}$ *[1 mark]*
$\Rightarrow u = 2500 \div 1.05^{80} = £50.44$
(to the nearest penny) *[1 mark]*

7. $b \propto a^5$, so $b = ka^5$ *[1 mark]*
When $a = 0.6$, $b = 0.23328$ so
$k = 0.23328 \div 0.6^5 = 3$ *[1 mark]*
You could have used one of the other two pairs of values from the table.
When $a = 1.2$,
$b = 3 \times 1.2^5 = 7.46496$ *[1 mark]*

Test 19 — Pages 38–39

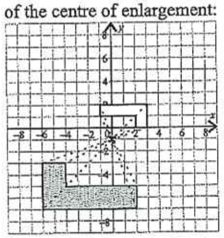
1. $x = 92 \div 1.15 = 80$ *[1 mark]*
2. $260 \div 1.18 = 220\text{ cm}^3$ (3 s.f.) *[1 mark]*
3. $r = ts^2$ *[1 mark]*
4. $4m = 10n$ so $n = \frac{4}{10}m$
$\frac{4}{10} \times 100 = 40\%$ *[1 mark]*
5. The difference in the amount of gravel and cement is $4 - 1 = 3$ parts.
So 12 kg = 3 parts and 1 part = 4 kg.
Then $2 \times 4 = 8$ kg of sand is used.
[1 mark for a correct method, 1 mark for the correct answer]
6. 25 mph = (25×1.6) km/h
$= 40$ km/h $= (40 \times 1000)$ m/h
$= 40\,000$ m/h $= (40\,000 \div 60)$ m/min
$= 666.66...$ m/min
$= (666.66... \div 60)$ m/s
$= 11.11...$ m/s $= 11.1$ m/s (1 d.p.)
[1 mark for converting miles to km, 1 mark for converting km to m, 1 mark for converting hours to seconds]
7. Amount in account A:
$500 \times 1.025^3 = £538.445...$ *[1 mark]*
Amount in account B:
$500 + (500 \times 0.05) + 2(500 \times 0.01)$
$= £535$ *[1 mark]*
So savings account A would contain the larger amount. *[1 mark]*

Section Five: Geometry and Measures

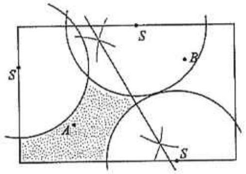
Test 20 — Pages 40–41

1. Bearing of B from A
$= 075° + 180° = 255°$ *[1 mark]*
2. Surface area $= \frac{1}{2} \times$ surface area of sphere + area of circular face
$= \frac{1}{2}(4\pi r^2) + \pi r^2 = 3\pi r^2$ *[1 mark]*

3. Scale factor –2 means the shape will be twice as big, on the opposite side of the centre of enlargement:



[1 mark for drawing the shape the correct size, 1 mark for drawing the shape in the correct position]
4. (–1, 1) *[1 mark]*
5. The roads form similar triangles, so their lengths are in the ratio
$150 : 250 = 3 : 5$ *[1 mark]*
So King Street is $300 \div 5 \times 3$
$= 180$ m long *[1 mark]*
6. Interior angle of the third shape =
$360° - 108° - 108° = 144°$. *[1 mark]*
Interior angle of a regular
n-sided polygon $= 180° - \frac{360°}{n}$.
So $180° - \frac{360°}{n} = 144°$
$\Rightarrow \frac{360°}{n} = 36° \Rightarrow n = 10$ *[1 mark]*
7.



[1 mark for correctly constructing circles around each point S, 1 mark for correctly constructing the perpendicular bisector of AB, 1 mark for shading the correct region]
Be careful — you'll lose a mark if your construction lines aren't shown, so make sure you don't rub them out.

Test 21 — Pages 42–43

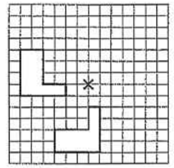
1. D *[1 mark]*
2. $\begin{pmatrix} 7 \\ -4 \end{pmatrix}$ *[1 mark]*
The shape has been moved 7 right and 4 down.
3. Alternate angles *[1 mark]*

4. Ratio of sides is $5 : 6$, so ratio of volumes is $5^3 : 6^3 = 125 : 216$
[1 mark] so volume of large can is:
$\frac{200}{125} \times 216 = 345.6\text{ cm}^3$ *[1 mark]*
You could also work out the scale factor of the heights (1.2) and cube this to find the scale factor of the volumes.
5. Triangle ABC is isosceles, so angle
$ACB = \frac{1}{2}(180° - 32°) = 74°$ *[1 mark]*
Angle DCE is vertically opposite ACB, so is also 74°. Triangle CDE is isosceles, so angle CDE
$= \frac{1}{2}(180° - 74°) = 53°$ *[1 mark]*
6. From the alternate segment theorem, angle $BCE = BAC = 54°$ *[1 mark]*.
AB is a diameter, so angle $ACB = 90°$.
Then $ACD = 180° - 90° - 54°$
$= 36°$ *[1 mark]*
7. The sum of the interior angles of a triangle is 180°. Since a regular n-sided polygon can be split into $(n-2)$ triangles, the sum of the interior angles is $(n-2) \times 180°$
$= 180°n - 360°$.
The polygon is regular, so each interior angle is $(180°n - 360°) \div n$
$= 180° - \frac{360°}{n}$
Then each exterior angle is
$180° - \left(180° - \frac{360°}{n}\right) = \frac{360°}{n}$
and the sum of the exterior angles is $n \times \frac{360°}{n} = 360°$
[1 mark for using the sum of interior angles, 1 mark for finding the size of one interior angle, 1 mark for finding the size of one exterior angle and summing them]

Test 22 — Pages 44–45

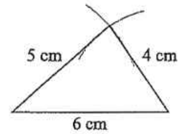
1. The angle subtended at the centre of the circle is twice the angle subtended at the circumference from the same two points,
so $x = \frac{50°}{2} = 25°$ *[1 mark]*
You could also use the fact that the triangles are isosceles to work out x.
2. Area of trapezium $= \frac{1}{2}(a+b)h$
$= \frac{1}{2}(5+7) \times 8 = 48\text{ cm}^2$ *[1 mark]*
3. Circumference $= \pi d = \pi \times 10 = 10\pi$
So arc $= 10\pi \div 2 = 5\pi$ *[1 mark]*
You could also use the formula for the length of an arc with angle = 180°.

4.



[1 mark]

5.



[1 mark for correct construction lines shown, 1 mark for triangle with correct measurements]
6. To make the cone as large as possible, diameter = x and perpendicular height = x *[1 mark]*
Volume of cone $= \frac{1}{3}\pi r^2 h$
$= \frac{1}{3}\pi\left(\frac{x}{2}\right)^2 x$ *[1 mark]*
$= \frac{1}{3}\pi\frac{x^2}{4}x = \frac{\pi x^3}{12}$ *[1 mark]*
7. Angles BAD and CAE are vertically opposite, so are equal. *[1 mark]*
Because A is half way between the parallel lines, $AB = AC$ and $AD = AE$. *[1 mark]*
Two sides and the angle between them are the same, so the triangles meet the SAS condition for congruence. *[1 mark]*
You could have also used alternate angles to show that ABD = ACE, and ADB = AEC, then used the AAS conditions for congruence.

Section Six: Pythagoras and Trigonometry

Test 23 — Pages 46–47

1. $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$ *[1 mark]*
To travel between (4, 5) and (8, 7), you move 8 – 4 = 4 units right and 7 – 5 = 2 units up.
2. $\frac{1}{2}$ *[1 mark]*
3. The labelled sides are opposite and adjacent to the angle, so
$\tan x = \frac{4}{10} = 0.4$ *[1 mark]*.
4. $\begin{pmatrix} 4+1+1 \\ 1-1-1 \end{pmatrix} = \begin{pmatrix} 6 \\ -1 \end{pmatrix}$ *[1 mark]*

5. $\sqrt{2^2+2^2+2^2}$ *[1 mark]*
$= \sqrt{12} = 2\sqrt{3}$ *[1 mark]*
6. Using the cosine rule:
$x^2 = 4^2 + 6^2 - 2 \times 4 \times 6 \times \cos 45°$
$= 16 + 36 - 48 \times \frac{1}{\sqrt{2}}$
$= 52 - \frac{48}{\sqrt{2}} = 4\left(13 - \frac{12}{\sqrt{2}}\right)$
[1 mark for putting numbers into the cosine rule formula, 1 mark fo the exact value of cos 45°, 1 mark for rearranging correctly to find y]
7. $\frac{\sin 60° + \sin 45°}{\tan 30°} = \frac{\frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}}}{\frac{1}{\sqrt{3}}}$ *[1 mar*
Multiply top and bottom by $\sqrt{3}$:
$\frac{\frac{\sqrt{3}\sqrt{3}}{2} + \frac{\sqrt{3}}{\sqrt{2}}}{\frac{\sqrt{3}}{\sqrt{3}}} = \frac{3}{2} + \frac{\sqrt{3}}{\sqrt{2}}$ *[1 mark]*
$= \frac{3}{2} + \frac{\sqrt{3}\sqrt{2}}{\sqrt{2}\sqrt{2}} = \frac{3}{2} + \frac{\sqrt{6}}{2}$
$= \frac{3+\sqrt{6}}{2}$ *[1 mark]*
If you used sin 45° = √2/2 or tan 30° = √3/3, your answer might loo a bit different but you should still get the same answer in the end.

Test 24 — Pages 48–49

1. $2\mathbf{a} - \mathbf{b} = 2\begin{pmatrix} 5 \\ 7 \end{pmatrix} - \begin{pmatrix} 3 \\ -2 \end{pmatrix}$
$= \begin{pmatrix} 10 \\ 14 \end{pmatrix} - \begin{pmatrix} 3 \\ -2 \end{pmatrix} = \begin{pmatrix} 7 \\ 16 \end{pmatrix}$ *[1 mark]*
2. $\sin t = \frac{2}{6}$ so $t = \sin^{-1}\left(\frac{2}{6}\right) = 19.471..$
Angle $ACB = 10 + 19.471...°$
$= 29°$ (nearest degree) *[1 mark]*
3. $\frac{1}{2} \times 11 \times 12 \times \sin 35° = 37.8560...$
$= 37.9\text{ cm}^2$ (3 s.f.) *[1 mark]*
4. Using Pythagoras' theorem:
$\sqrt{20^2 + 15^2} = 25$ cm *[1 mark]*
5. Using the sine rule:
$\frac{14}{\sin u} = \frac{7v}{\sin 30°}$
$\Rightarrow \sin u = \frac{14 \sin 30°}{7v}$ *[1 mark]*
$= \frac{2 \times 0.5}{v} = \frac{1}{v}$ *[1 mark]*
6. $\overrightarrow{BD} = -\mathbf{a} + \mathbf{b}$ *[1 mark]*
$BX:XD = 1:3$ so $BX:BD = 1:4$
$\overrightarrow{BX} = \frac{1}{4}\overrightarrow{BD} = -\frac{1}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$ *[1 mark*

7. Let x = the side length of the cube.
Using Pythagoras' theorem in 2D:
$AB = \sqrt{x^2 + x^2} = \sqrt{2}x$ *[1 mark]*
Using Pythagoras' theorem in 3D:
$BC = \sqrt{x^2 + x^2 + x^2} = \sqrt{3}x$ *[1 mark]*
Then using the cosine rule:
$\cos ABC = \frac{AB^2 + BC^2 - AC^2}{2 \times AB \times BC}$
$= \frac{2x^2 + 3x^2 - x^2}{2\sqrt{6}x^2}$ *[1 mark]*
$= \frac{2+3-1}{2\sqrt{6}} = \frac{4}{2\sqrt{6}} = \frac{4\sqrt{6}}{2\sqrt{6}\sqrt{6}}$
$= \frac{4\sqrt{6}}{12} = \frac{\sqrt{6}}{3}$
[1 mark for correct rearrangement by rationalising the denominator]

Test 25 — Pages 50–51

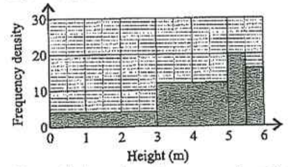
1. $-\mathbf{m}$ *[1 mark]*
2. Let s be the length of the unknown side. Using Pythagoras' theorem:
$41^2 = 40^2 + s^2$
$s = \sqrt{41^2 - 40^2} = 9$ cm *[1 mark]*
3. $\cos 38° = \frac{AB}{15}$
$\Rightarrow AB = 15 \cos 38° = 11.820...$
$= 11.8$ cm (1 d.p.) *[1 mark]*
4. Using the sine rule:
$\frac{b}{0.45} = \frac{4}{0.97}$ *[1 mark]*
$b = \frac{4 \times 0.45}{0.97} = 1.9$ (2 s.f.) *[1 mark]*
5. $\overrightarrow{CD} = -(\mathbf{p} + \mathbf{q}) + (\mathbf{q} - \mathbf{p})$
$= -2\mathbf{p}$ *[1 mark]*
$\overrightarrow{CD}$ is a scalar multiple of $\overrightarrow{AB}$ so AB and CD are parallel lines. *[1 mark]*
6. MPT is a right-angled triangle, so
$\sin 72° = \frac{15}{PT}$ *[1 mark]*
$\Rightarrow PT = \frac{15}{\sin 72°}$
$= 15.8$ cm (1 d.p.) *[1 mark]*
7. Let the angle between the 6 cm and 7 cm sides be $x°$.
Using the cosine rule:
$\cos x = \frac{6^2 + 7^2 - 8^2}{2 \times 6 \times 7}$ *[1 mark]* $= \frac{1}{4}$
$x = \cos^{-1}\left(\frac{1}{4}\right) = 75.5224...°$ *[1 mark]*
Area $= \frac{1}{2} \times 6 \times 7 \times \sin 75.5224...°$
$= 20.333...$
$= 20.3$ cm² (1 d.p.) *[1 mark]*

Section Seven: Probability and Statistics

Test 26 — Pages 52–53

1. quantitative discrete *[1 mark]*
Quantitative since it's numerical and discrete since it can only take certain values (non-negative integers).
2. $3 \times 3 \times 3 \times 3 \times 3 \times 3 = 729$ *[1 mark]*
3. $80 \div 2 = 40$. Reading across from 40, the median height is 1.6 m *[1 mark]*.
4. P(never red) = P(not red) × P(not red)
$= \frac{4}{8} \times \frac{3}{7}$ *[1 mark]* $= \frac{3}{14}$ *[1 mark]*
5. $360° = x + 90° + x + 70° + 3x$
$\Rightarrow 5x = 200° \Rightarrow x = 40°$ *[1 mark]*
Number of blueberry pies sold
$= \frac{252}{360°} \times 40° = 28$ *[1 mark]*
6. Jul-Sep 2018 is outside the range of the known data (i.e. this is extrapolating). *[1 mark]*
She hasn't taken into account the seasonality. / The amount spent in Jul-Sep is always lower than the trend line. *[1 mark]*
7. Mid-interval values (x):
100, 250, 350, 500
Frequencies × mid-intervals (fx):
200, 3500, 3850, 2000
Sum of fx = 9550, sum of f = 31
Mean $= \frac{9550}{31} = 308.064...$ ml
The modal class is $200 < v \leq 300$ so the mean is not in the modal class.
[1 mark for a correct method to estimate the mean, 1 mark for estimating the mean correctly, 1 mark for finding the modal class and giving the correct conclusion]

4. Number in complement of A
$= 20 + 18 = 38$ *[1 mark]*
Total number of elements
$= 50 + 42 + 20 + 28 = 130$
P(complement of A)
$= \frac{38}{130} = \frac{19}{65}$ *[1 mark]*
5. $0 < h \leq 3$: f.d. $= 12 \div 3 = 4$
$3 < h \leq 5$: f.d. $= 24 \div 2 = 12$
$5 < h \leq 5.5$: f.d. $= 10 \div 0.5 = 20$
$5.5 < h \leq 6$: f.d. $= 8 \div 0.5 = 16$



[1 mark for using frequency density = frequency ÷ class width, 1 mark for the fully correct histogram]
6. The oldest member = 18 + 20 = 38.
The greatest value of the mean is when all other members are 38.
$20 + (5 \times 38) = 210$ *[1 mark]*
$\Rightarrow$ mean $\leq 210 \div 6 = 35$ *[1 mark]*
7. P(escape) = P(X and escape) + P(Y and escape) + P(Z and escape)
P(X and escape) $= \frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$
P(Y and escape) $= \frac{1}{3} \times \frac{1}{6} = \frac{1}{18}$
P(Z and escape) $= \frac{1}{3} \times \frac{1}{8} = \frac{1}{24}$
P(escape) $= \frac{1}{12} + \frac{1}{18} + \frac{1}{24} = \frac{13}{72}$
$= 0.181$ (3 s.f.)
[1 mark for finding the probability of escaping through one of the doors, 1 mark for finding the probability of escaping through all three doors, 1 mark for the correct final answer]
You might find it helpful to use a tree diagram to answer this question.

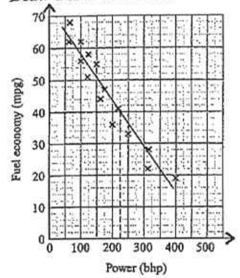
Test 27 — Pages 54–55

1. For mutually exclusive events,
P(A or B) = P(A) + P(B).
So P(B) = $x - 0.6$ *[1 mark]*
2. $\frac{1}{4} \times 40 = 10$ *[1 mark]*
3. A fair wheel should land on each option about 25 times. Either:
All of the frequencies are close to 25 so the wheel seems to be fair.
Or: 'big prize' is further away from 25 than the others so the wheel is probably not fair. ***[1 mark for an answer with a correct justification]***

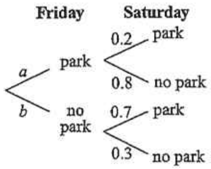
Test 28 — Pages 56–57

1. In ascending order:
14 16 25 25 <u>26</u> 28 31 34 53
The middle value is 26. *[1 mark]*
2. P(H, even) $= \frac{1}{2} \times \frac{3}{6}$
$= \frac{3}{12} = \frac{1}{4}$ *[1 mark]*
3. Strong negative correlation *[1 mark]*

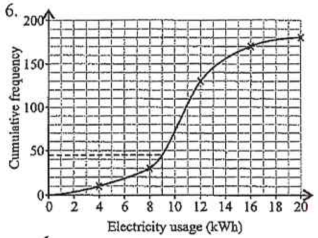
4. Draw a line of best fit:



Read up from 225 bhp and across to 40 mpg *[1 mark]*
Accept any answer from 38-42 mpg.
5.



P(no park, no park) = $b \times 0.3 = 0.15$
$\Rightarrow b = 0.5$ *[1 mark]*
$\Rightarrow a = 1 - 0.5 = 0.5$
So P(park, park)
$= 0.5 \times 0.2 = 0.1$ *[1 mark]*
6.



$\frac{1}{4} \times 180 = 45$ and reading across from 45 gives a lower quartile of 9 kWh. *Your quartile will depend on how you've drawn your curve.*
[1 mark for plotting the correct points, 1 mark for joining them with a smooth curve, 1 mark for a lower quartile read correctly from your curve]
7. P(A or B) = P(A) + P(B) − P(A and B)
0.7 = P(A) + 0.5 − P(A) × 0.5 *[1 mark]*
$\Rightarrow$ P(A) = 0.4 *[1 mark]*
P(A and C) = P(A) × P(C)
$\Rightarrow$ 0.3 = 0.4 × P(C)
$\Rightarrow$ P(C) = 0.75 *[1 mark]*

Test 29 — Pages 58–59

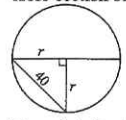
1. $\left(\frac{1}{3} \times \frac{2}{3}\right) + \left(\frac{2}{3} \times \frac{1}{3}\right) = \frac{4}{9}$ *[1 mark]*
2. $30 \div 200 = 0.15$
$0.15 \times 27000 = 4050$ *[1 mark]*
3. IQR = upper quartile − lower quartile
= 138 − 96 = 42 minutes *[1 mark]*
4. No, you cannot tell. The ranges only tell you about the spread of the data, not the average. *[1 mark]*
5. P(phone fault or charger fault)
= 1 − P(neither have a fault)
= 1 − (0.98 × 0.92) *[1 mark]*
= 1 − 0.9016 = 0.0984 *[1 mark]*
6. Number who threw the hammer between 0 m and 40 m
= (0.6 × 20) + (1.2 × 20)
= 36 athletes *[1 mark]*
Number who threw it between 40 m and 50 m = 2.6 × 10 = 26 athletes.
Estimate that half of these threw it less than 45, so 13 athletes *[1 mark]*.
So total estimate
= 36 + 13 = 49 athletes *[1 mark]*
7. Disliked before and liked after:
$(x - y) - \frac{x-y}{2} = \frac{x-y}{2}$ *[1 mark]*
Liked before and liked after:
$120 - \frac{x-y}{2}$ *[1 mark]*
Liked before: $x - (x - y) = y$
Liked before and disliked after:
$y - \left(120 - \frac{x-y}{2}\right)$
$= \frac{1}{2}x + \frac{1}{2}y - 120$ *[1 mark]*

Section Eight: Mixed Practice

Test 30 — Pages 60–61

1. tan 45° *[1 mark]*
2. (−6, −4) *[1 mark]*
3. $y \propto x^3$ so $y = kx^3$
Let $x_1 = 2x$ (i.e. x doubled).
Then $y_1 = kx_1^3 = k(2x)^3 = 8kx^3 = 8y$
So y is multiplied by 8 *[1 mark]*.
4. $p(p-2)(p+1) + 2p^2\left(p + \frac{1}{p}\right)$
$= p(p^2 - p - 2) + 2p^3 + 2p$ *[1 mark]*
$= p^3 - p^2 - 2p + 2p^3 + 2p$
$= 3p^3 - p^2$ or $p^2(3p - 1)$ *[1 mark]*

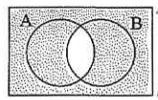
5. $BCE = 113°$ (corresponding angles
$DCE = 180° - 113° = 67°$ *[1 mark*
Since the triangle CDE is isosceles the angle $CDE = CED$ and so
$180° = 67° + 2CED$
$\Rightarrow CED = 113° \div 2 = 56.5°$ *[1 ma*
6. There is a curved face and three fla faces. Each flat face is one quarter of the centre circle, so their areas a
$\frac{1}{4} \times \pi r^2$ *[1 mark]*. The area of the curved face is $\frac{1}{8} \times 4\pi r^2$. So the tot area is $3(\frac{1}{4} \times \pi r^2) + (\frac{1}{8} \times 4\pi r^2)$
$= \frac{3}{4}\pi r^2 + \frac{2}{4}\pi r^2 = \frac{5}{4}\pi r^2$. *[1 mark]*
7. Let r be the radius of the cross-section of the pipe.



Then $r^2 + r^2 = 40^2$ *[1 mark]*
$\Rightarrow 2r^2 = 1600 \Rightarrow r^2 = 800$ *[1 mar*
Volume $= \pi \times 800 \times 200$
$= 160\,000\pi$ cm³ *[1 mark]*

Test 31 — Pages 62–63

1. $y = x^2$ gives 1
$y = \sin 2x < 1$ for all x
$y = 2x$ gives 2
$y = \frac{x}{2}$ gives 0.5
So $y = 2x$ is the greatest *[1 mark]*.
2.



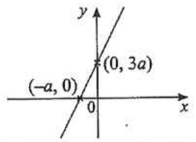
[1 mark]
3. Half the base is 1 cm.
Using Pythagoras' theorem:
$q = \sqrt{2^2 - 1^2} = \sqrt{4 - 1}$
$= \sqrt{3}$ cm *[1 mark]*
4. $r = 3.222... \Rightarrow 10r = 32.22...$
$10r - r = 32.22... - 3.222...$ *[1 mar*
$9r = 29 \Rightarrow r = \frac{29}{9}$ *[1 mark]*
5. $\overrightarrow{PQ} = (2\mathbf{a} + \mathbf{b}) - (\mathbf{a} - \mathbf{b}) = \mathbf{a} + 2\mathbf{b}$
$\overrightarrow{QR} = (\mathbf{a} - \mathbf{b}) + 3\mathbf{b} = \mathbf{a} + 2\mathbf{b}$
$\overrightarrow{PQ} = \overrightarrow{QR}$ and they have a commor point (Q), so form a straight line.
[1 mark for working out either $\overrightarrow{PQ}$ or $\overrightarrow{QR}$, 1 mark for working out the other vector and showing PQR is a straight line]
You could also work out $\overrightarrow{PR}$ and show that it's a scalar multiple of $\overrightarrow{PQ}$ or $\overrightarrow{Q}$

6. They work for 10 hours in total. There are $2 + 3 = 5$ parts. First security guard usually patrols for $10 \div 5 \times 2 = 4$ hours *[1 mark]* So the new time is 4.5 hours, leaving 5.5 hours for the other guard: $4.5 : 5.5 = 45 : 55 = 9 : 11$ *[1 mark]*

7. $u_2 = \sqrt{2} \times -(6 + 3\sqrt{2}) + \sqrt{18}$
$= -6\sqrt{2} - 3\sqrt{4} + \sqrt{18}$ *[1 mark]*
$= -6\sqrt{2} - 6 + 3\sqrt{2}$
$= -(6 + 3\sqrt{2}) = u_1$ *[1 mark]*
So $u_k = u_1$ for all k.
Therefore, $u_{40} = u_1$. *[1 mark]*

Test 32 — Pages 64–65

1. Common multiples of 10 and 16: 80, 160, 240, 320, ... 160, 240 and 320 aren't factors of 400 so $n = 80$ *[1 mark]*
2. $x^2 + y^2 \leq 9$ *[1 mark]*
3. Area of shaded region $= \pi \times 3^2 = 9\pi$
Area of square grid is $10^2 = 100$
Probability $= \frac{9\pi}{100}$
$= 0.28$ (2 d.p.) *[1 mark]*
4. Reducing 5.5 by 12%:
$5.5 \times 0.88 = 4.84$ km² *[1 mark]*
7% of $3.2 = 3.2 \times 0.07 = 0.224$ km²
So the total land is $4.84 + 0.224 = 5.064$ km² *[1 mark]*
5. $y - 3x - 3a = 0 \Rightarrow y = 3x + 3a$
y-intercept is when $y = 3a$
x-intercept is when $3x + 3a = 0$
$\Rightarrow 3x = -3a \Rightarrow x = -a$



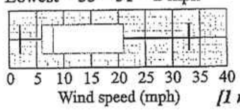
[1 mark for a straight line with correct y-intercept, 1 mark for the correct x-intercept]

6. Probability of not picking a square counter in any particular bag $= \frac{2}{3}$ *[1 mark]*
Probability of not picking a square counter in all the bags
$= \frac{2}{3} \times \frac{2}{3} \times ... \times \frac{2}{3} = \left(\frac{2}{3}\right)^{10}$
$= 0.0173$ (3 s.f.) *[1 mark]*

7. Let x be the width of the divisions on the graph. Using frequency = frequency density × width:
$255 = (10 \times 5x) + (30 \times 5x) + (46 \times x) + (40 \times 3x) + (24 \times 6x)$ *[1 mark]*
$\Rightarrow 510x = 255 \Rightarrow x = 0.5$ *[1 mark]*
£5 is at the $5 \div 0.5 = 10$th division.
So the last three bars represent prices greater than £5.
$(46 \times 0.5) + (40 \times 1.5) + (24 \times 3) = 155$ cinemas *[1 mark]*

Test 33 — Pages 66–67

1. -2 *[1 mark]*
Using the difference of two squares.
2. 5 parts of the road are covered, so $12 - 5 = 7$ parts are not covered.
1 part $= 100 \div 5 = 20$ m, so
7 parts $= 7 \times 20 = 140$ m *[1 mark]*.
3. Greatest $= 8 + 25 = 33$ mph
Lowest $= 33 - 31 = 2$ mph



[1 mark]

4. $\sin x = \frac{b}{c}$ *[1 mark]*
5. The maximum distance is 400.5 m and the minimum time is 51.5 seconds. *[1 mark for both]*
Speed = distance ÷ time
so $400.5 \div 51.5$
$= 7.78$ m/s (2 d.p.) *[1 mark]*
6. $h(x) = fg(x) = f(x + 2)$
$= \sqrt{x + 2}$ *[1 mark]*
Let $x = h(y)$, so $x = \sqrt{y + 2}$
$\Rightarrow x^2 = y + 2 \Rightarrow x^2 - 2 = y$
So $h^{-1}(x) = x^2 - 2$ *[1 mark]*
$h^{-1}(x) = 0 \Rightarrow x^2 - 2 = 0$
$\Rightarrow x^2 = 2 \Rightarrow x = \sqrt{2}$ *[1 mark]*
You don't need to take the negative square root here as x is positive.
7. After 10 seconds, radius of big circle $= 5 \times 1.4^{10} = 144.627...$ cm
Radius of small circle
$= 2 \times 1.4^{10} = 57.850...$ cm
[1 mark for both]
Area of shaded region
$= \pi \times (144.627...)^2 - \pi \times (57.850...)^2$ *[1 mark]*
$= 55\ 198.83$ cm² (2 d.p.) *[1 mark]*
You could also work out the initial shaded area and multiply it by $(1.4^{10})^2$.

Test 34 — Pages 68–69

1. The +3 translates the graph 3 units left. Since (90, 0) is an x-intercept of $y = \cos x$, an intercept of $y = \cos(x + 3)$ will be $(90 - 3, 0) = (87, 0)$. *[1 mark]*
2. $\frac{\sqrt{x}}{x^n} = \frac{x^{\frac{1}{2}}}{x^n} = x^{\frac{1}{2} - n}$ *[1 mark]*
3. $\mathbf{a} + 3\mathbf{b} = \begin{pmatrix} x \\ -y \end{pmatrix} + \begin{pmatrix} 3 \times 2x \\ 3 \times y \end{pmatrix}$
$= \begin{pmatrix} x + 6x \\ -y + 3y \end{pmatrix} = \begin{pmatrix} 7x \\ 2y \end{pmatrix}$ *[1 mark]*
4. Let s be the amount of sewage and p be the population of the town. Then $s \propto p$, so $s = kp$
When $p = 10\ 000$, $s = 1\ 620\ 000$ and so $k = 1\ 620\ 000 \div 10\ 000$
$= 162$ *[1 mark]*
When $p = 17\ 000$,
$s = 162 \times 17\ 000$
$= 2\ 754\ 000$ litres *[1 mark]*
5. Set the equations equal to each other to find the point of intersection:
$5x - 3 = \frac{1}{ax}$
$\Rightarrow a = \frac{1}{x(5x - 3)}$ *[1 mark]*
Substituting in $x = 1$:
$a = \frac{1}{1 \times (5 \times 1 - 3)} = \frac{1}{2}$ *[1 mark]*
6. Median $= (7 + 5) \div 2 = 6$ eggs
Mean $= \frac{0 + 3 + 5 + 7 + 7 + e}{6}$
$= \frac{22 + e}{6}$ *[1 mark]*
Mean > median so $\frac{22 + e}{6} > 6$
$\Rightarrow 22 + e > 36 \Rightarrow e > 14$
So the smallest possible value of e is 15 eggs. *[1 mark]*
7. 1 km = 1000 m = 100 000 cm
Volume $= 6.254 \times 10^{13}$ km³
$= (6.254 \times 10^{13} \times 100\ 000^3)$ cm³
$= (6.254 \times 10^{28})$ cm³ *[1 mark]*
Mass $= 1.0243 \times 10^{26}$ kg
$= (1.0243 \times 10^{26} \times 1000)$ g
$= (1.0243 \times 10^{29})$ g *[1 mark]*
Density
$= (1.0243 \times 10^{29}) \div (6.254 \times 10^{28})$
$= 1.64$ g/cm³ (3 s.f.) *[1 mark]*

MQHXP41_MXHXP41

Progress Chart

Here's a handy chart to stick your scores in, so you can keep track of how you're doing.

Number	Test 1	
	Test 2	
	Test 3	
	Test 4	
Algebra	Test 5	
	Test 6	
	Test 7	
	Test 8	
	Test 9	
	Test 10	
Graphs	Test 11	
	Test 12	
	Test 13	

Ratio, Proportion and Rates of Change	Test 14	
	Test 15	
	Test 16	
	Test 17	
	Test 18	
	Test 19	
Geometry and Measures	Test 20	
	Test 21	
	Test 22	
Pythagoras and Trigonometry	Test 23	
	Test 24	
	Test 25	

Probability and Statistics	Test 26	
	Test 27	
	Test 28	
	Test 29	
Mixed Practice	Test 30	
	Test 31	
	Test 32	
	Test 33	
	Test 34	

Some blindingly obvious advice:

- If a test didn't go too well, go away and revise that topic before you try the next test.
- Focus your revision on the topics you're struggling with — don't just do the stuff you find easiest!

0918 - 18010

1 Start with Confidence...

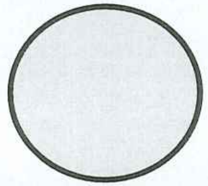
ACCESS MATHS

Round 34,565 to the nearest 1000.

How many minutes are in 4.5 hours?

Write 6.5459 correct to 2 decimal places

Draw a chord



Write $\frac{3}{5}$ as a percentage

7 , 8 , 4 , 9

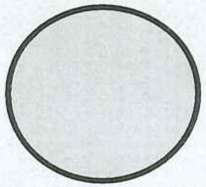
Write the largest 4 digit even number

Write in size order

4.25 , 4.02 , 4.205 , 4.2

Write 3.4556 correct to 3 significant figures

Draw a tangent



Work out 1.6^2

Work out 30% of £64

5 , 3 , 4 , 8

Write the smallest 4 digit odd number

There are 4 coloured pens in a box: red, blue, green and yellow. 2 are taken. Write all the possible combinations.

Write down the 19th odd number

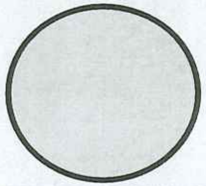
Write in size order

4 , -2 , -4 , 2 , 0

$\frac{3}{5}$ of sweets are red and the rest are blue. Write the ratio blue to red.

② Start with Confidence...

ACCESS MATHS

Write the value of 4 in the number 5432	Write 3.75ml in litres	10 , 36 , 7 , 42 , 18 Circle a multiple of 4	43 children, 18 are girls. What is the probability of picking boy?
What is the probability of rolling a 4 on a regular 6 sided dice?	Simplify $3x - 4y + 5x - 7y$	Expand $3x(4 - x)$	14 , 11 , 8 , 5 Write the next term
Draw the radius 	Write down an even cube number	Write $\frac{7}{16}$ as a decimal	Solve $3x - 7 = 11$
Convert $2500mm^2$ into m^2	Write 0.047 as a fraction	Factorise $8n - 6$	Write down all the factors of 24