Candidate Name	Centre Number					Candidate Number				
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GCSE

MATHEMATICS
UNIT 2: CALCULATOR-ALLOWED
HIGHER TIER

2nd SPECIMEN PAPER SUMMER 2017

1 HOUR 45 MINUTES

ADDITIONAL MATERIALS
A calculator will be required for this paper.
A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES
Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided in this booklet.

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

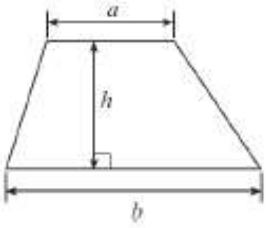
The number of marks is given in brackets at the end of each question or part-question.

The assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing in question **9**.

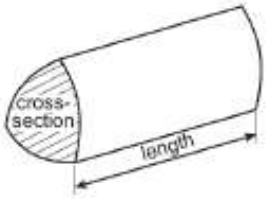
For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**2**	
3.	**4**	
4.	**6**	
5.	**3**	
6.	**6**	
7.	**7**	
8.	**5**	
9.	**7**	
10.	**5**	
11.	**3**	
12.	**7**	
13.	**6**	
14.	**7**	
15.	**7**	
TOTAL	**80**	

Formula list – Higher tier

Area of a trapezium = $\frac{1}{2}(a+b)h$



Volume of a prism = area of cross section × length

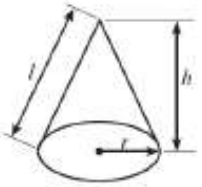


Volume of a sphere = $\frac{4}{3}\pi r^3$

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

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

Curved surface area of a cone = $\pi r l$

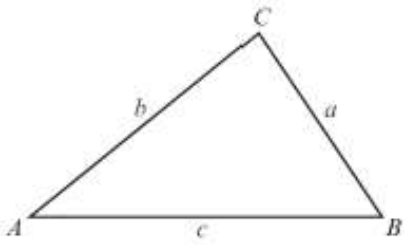


In any triangle ABC,

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 = $\frac{1}{2}ab\sin C$



The Quadratic Equation

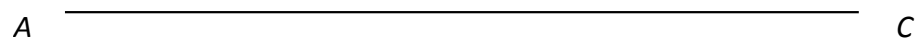
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1+\frac{i}{n}\right)^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

1. Use a ruler and a pair of compasses to construct triangle ABC where $AC = 10{\cdot}5\,\text{cm}$, $A\hat{C}B = 60°$ and $C\hat{A}B = 45°$.
Line AC has been drawn for you.

[5]



2. Circle either TRUE or FALSE for each statement given below.

[2]

STATEMENT		
Circles with diameters of equal length are congruent.	TRUE	FALSE
Regular pentagons whose perimeters are of equal length are congruent.	TRUE	FALSE
Scalene triangles that have the same three angles are congruent.	TRUE	FALSE
Rectangles with equal areas are congruent.	TRUE	FALSE

3. A solution to the equation

$$x^3 - 6x - 4 = 0$$

lies between 2 and 3.

Use the method of trial and improvement to find this solution correct to 1 decimal place.
You must show all your working.

[4]

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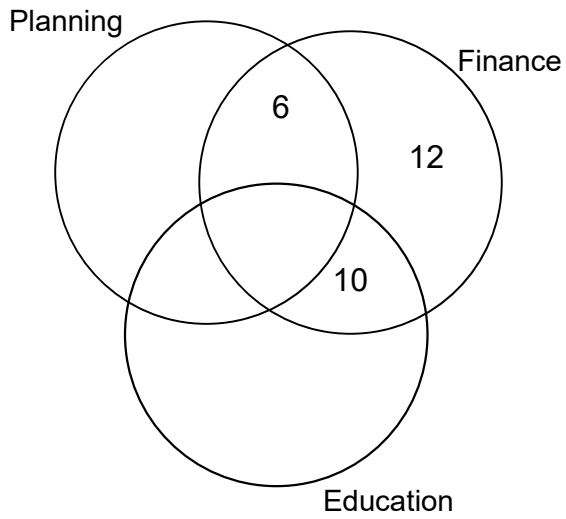
4. A total of 45 councillors make up the Planning, Finance and Education committees of a local council.
Some of the councillors sit on two of these committees.
No councillor sits on all three committees.

2 councillors sit on both the Planning Committee and the Education Committee.
There are 18 councillors on the Education Committee.

(a) Complete the Venn diagram.

[3]



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(b) How many councillors sit on both the Planning and Finance committees?

[1]

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(c) One of these 45 councillors is chosen at random.
What is the probability that this councillor is on the Planning Committee?

[2]

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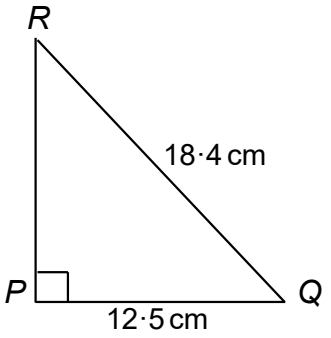

Diagram not drawn to scale

Calculate the length of *PR*, giving your answer correct to 1 decimal place.

[3]

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6. A bus company advertises two prices for a return journey between Aberystwyth and Cardiff: an adult price and the price for a child.

A family of 2 adults and 3 children paid a total of £71.50 for their tickets.
A group consisting of 3 adults and 4 children paid a total of £101 for their tickets.

Use an algebraic method to calculate the total amount paid by a group of 4 adults and 2 children.

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7. *(a)* Factorise $x^2 - 4x - 21$, and hence solve $x^2 - 4x - 21 = 0$.

[3]

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(b) Solve the equation $\frac{x-7}{4} + \frac{2x+5}{8} = \frac{1}{2}$.

[4]

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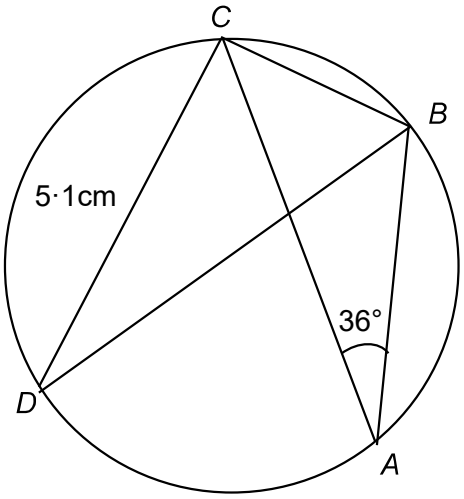

Diagram not drawn to scale

Points *A*, *B*, *C* and *D* lie on the circumference of a circle. *BD* is the diameter of the circle, *CD* = 5·1 cm and $B\hat{A}C$ = 36º.

Calculate the length of the chord *BC*.
You must give reasons as part of your solution.

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9. *You will be assessed on the quality of your organisation, communication and accuracy in writing in this question.*

Geralllt ran the 400 m race in an Urdd sports event. This distance was measured correct to the nearest 0·5 m.
The time it took him was 74 seconds, measured correct to the nearest second.

Calculate Geralllt's least possible average speed **and** greatest possible average speed.
Give your answers to 3 significant figures.
You must show your working.

[5 + OCW 2]

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10. *(a)* Express $0 \cdot 4\dot{9}\dot{1}$ as a fraction.

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(b) Is the following statement true or false? Circle the correct answer.
You must give a full explanation of your decision.

The evaluation of $a^{\frac{2}{3}}$ will always be an integer provided a is a multiple of 3.

[1]

true / false

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(c) Circle your answer in each of the following.

(i) $\sqrt{200}$ simplifies to

20 $10\sqrt{2}$ $20\sqrt{10}$ $100\sqrt{2}$ $2\sqrt{10}$

[1]

(ii) $\sqrt{5} + \sqrt{45}$ simplifies to

$\sqrt{50}$ $\sqrt{225}$ $4\sqrt{5}$ $10\sqrt{5}$ $4\sqrt{10}$

[1]

11. The table below shows the number of people employed by a graphic design company.

	Male	Female
Full-time	125	30
Part-time	18	87

The company plans to take a stratified sample of 40 members of staff, to find out their views on how the company could be improved.
Calculate the number of staff from each of the four categories that should be in the sample.

[3]

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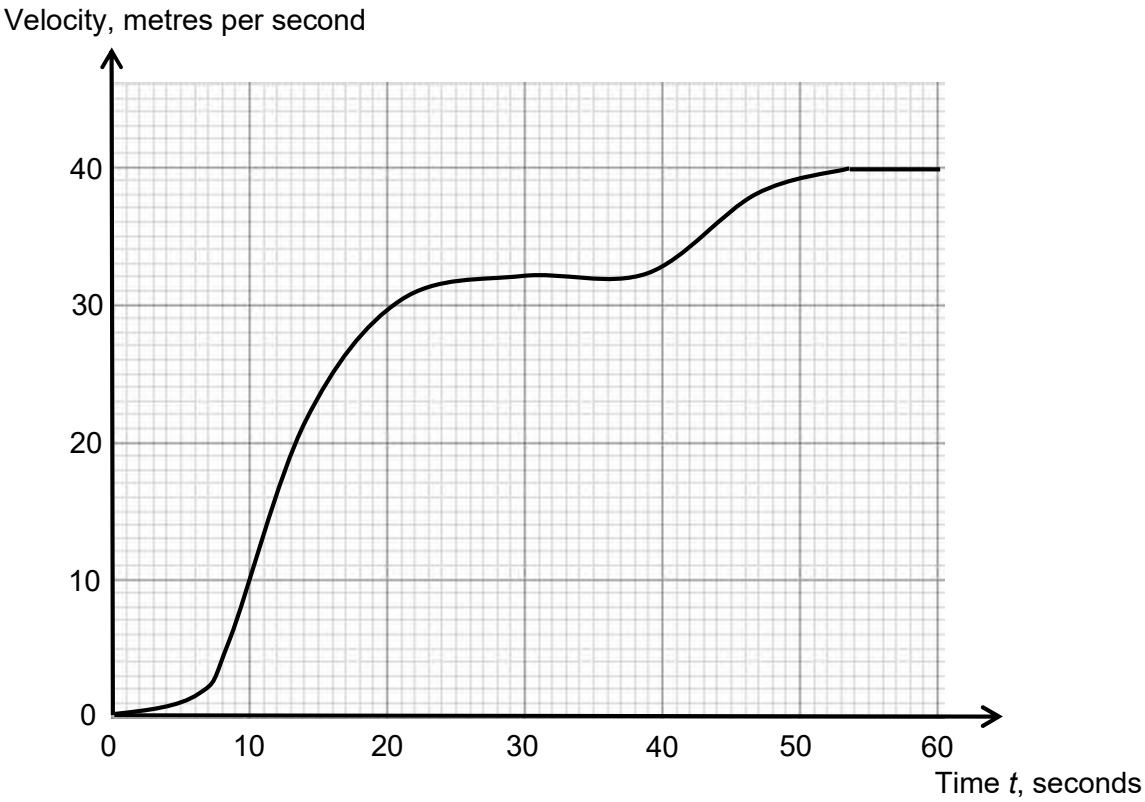
12. The velocity-time graph shows the first 60 seconds of a train's journey from a station.



(a) Calculate an estimate of the acceleration of the train when $t = 20$ seconds.
State the units of your answer.

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(b) Use the trapezium rule with ordinates t = 0, t = 10, t = 20, t = 30, t = 40, t = 50 and t = 60 to calculate an estimate of the distance travelled by the train in the first 60 seconds of its journey.

[3]

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13. A right-circular cone of vertical height 10 cm and base radius 5 cm is attached to a cylinder of the same radius and height 8 cm.

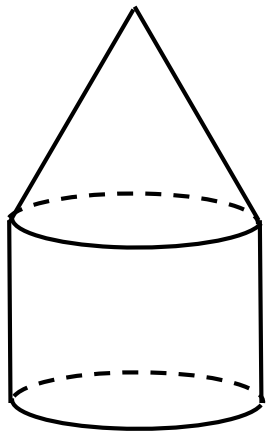

Diagram not drawn to scale

Calculate the total surface area of the shape.

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14.

(a) Show that the equation $\frac{3}{2x-1} - \frac{5}{x+4} = 6$ can be written as $12x^2 + 49x - 41 = 0$.

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(b) Hence solve the equation $\frac{3}{2x-1} - \frac{5}{x+4} = 6$.

Give your answers correct to 2 decimal places. [3]

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15. In the parallelogram $ABCD$, $AB = 12{\cdot}7\,\text{cm}$ and $D\hat{A}B = 132°$.

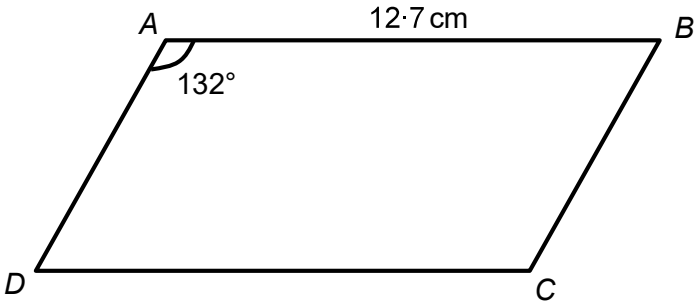

Diagram not drawn to scale

The area of the parallelogram is $48{\cdot}5\,\text{cm}^2$.
Calculate the length of the diagonal DB.

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END OF PAPER