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National  
Qualifications  
2019

Mark

**X847/75/01**

**Mathematics  
Paper 1 (Non-calculator)**

FRIDAY, 3 MAY

9:00 AM – 10:15 AM



\* X 8 4 7 7 5 0 1 \*

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day

Month

Year

Scottish candidate number

**Total marks — 50**

Attempt ALL questions.

**You may NOT use a calculator.**

To earn full marks you must show your working in your answers.

State the units for your answer where appropriate.

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\* X 8 4 7 7 5 0 1 0 1 \*

## FORMULAE LIST

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

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

Cosine rule  $a^2 = b^2 + c^2 - 2bc \cos A$  or  $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

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

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

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

Volume of a pyramid  $V = \frac{1}{3}Ah$

Standard deviation  $s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$

or  $s = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n - 1}}$ , where  $n$  is the sample size.



\* X 8 4 7 7 5 0 1 0 2 \*

MARKS

DO NOT  
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Total marks — 50  
Attempt ALL questions

1. Given that  $f(x) = 5x^3$ , evaluate  $f(-2)$ .

2

2. Evaluate  $\frac{3}{8} \times 1\frac{5}{7}$ .

Give your answer in its simplest form.

2

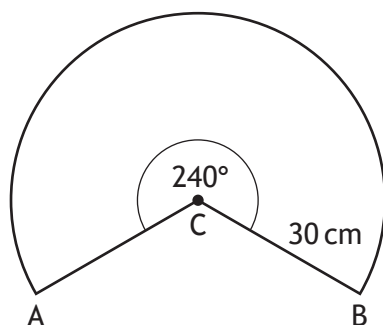


\* X 8 4 7 7 5 0 1 0 3 \*

3. Expand and simplify  $(x+5)(2x^2-7x-3)$ .

3

4. The diagram below shows a sector of a circle, centre C.



The radius of the circle is 30 centimetres.

Calculate the length of the major arc AB.

Take  $\pi = 3.14$ .

3



5. The midday temperatures in Grantford were recorded over a nine day period. The temperatures, in °C, were

4 7 4 3 6 10 9 5 3

- (a) Calculate the median and semi-interquartile range for these temperatures. 3

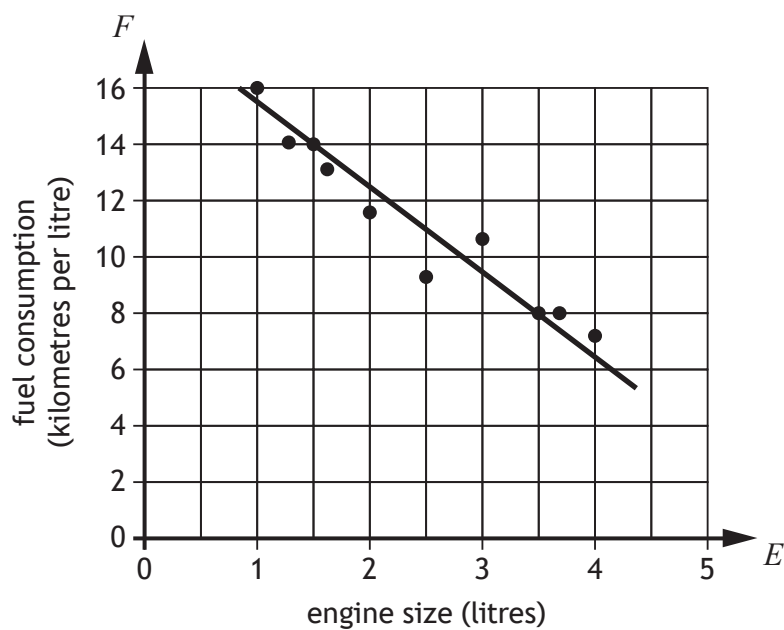
Over the same nine day period the midday temperatures in Endoch were also recorded.

The median temperature was 8 °C, and the semi-interquartile range was 1.5 °C.

- (b) Make two valid comments comparing the midday temperatures of Grantford and Endoch during this period. 2



6. The fuel consumption of a group of cars is recorded.  
 The scattergraph shows the relationship between the fuel consumption,  $F$  kilometres per litre, and the engine size,  $E$  litres, of the cars.



A line of best fit has been drawn.

- (a) Find the equation of the line of best fit in terms of  $F$  and  $E$ .  
 Give the equation in its simplest form.

3



6. (continued)

Amaar's car has an engine size of 1.1 litres.

- (b) Use your equation from part (a) to estimate how many kilometres per litre he should expect to get.

1

7. The area of a trapezium is given by the formula

$$A = \frac{1}{2}h(x + y).$$

Make  $x$  the subject of the formula.

3



\* X 8 4 7 7 5 0 1 0 7 \*

8. John bought 7 bags of cement and 3 bags of gravel.

The total weight of these bags was 215 kilograms.

- (a) Write down an equation to illustrate this information.

1

Shona bought 5 bags of cement and 4 bags of gravel.

The total weight of her bags was 200 kilograms.

- (b) Write down an equation to illustrate this information.

1

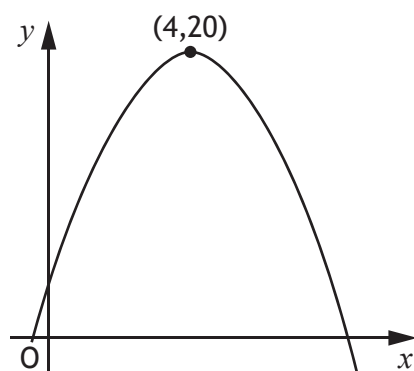
- (c) Calculate the weight of one bag of cement and the weight of one bag of gravel.

4





9. The graph shows a parabola.



The maximum turning point has coordinates (4,20) as shown in the diagram.

(a) Write down the equation of the axis of symmetry of the graph. 1

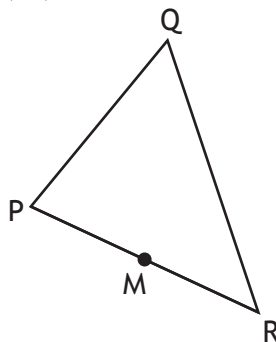
The equation of the parabola is of the form  $y = b - (x + a)^2$ .

(b) State the values of  
 (i)  $a$  1

(ii)  $b$ . 1



10. In triangle PQR,  $\vec{PR} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$  and  $\vec{RQ} = \begin{pmatrix} -1 \\ 8 \end{pmatrix}$ .



- (a) Express  $\vec{PQ}$  in component form.

1

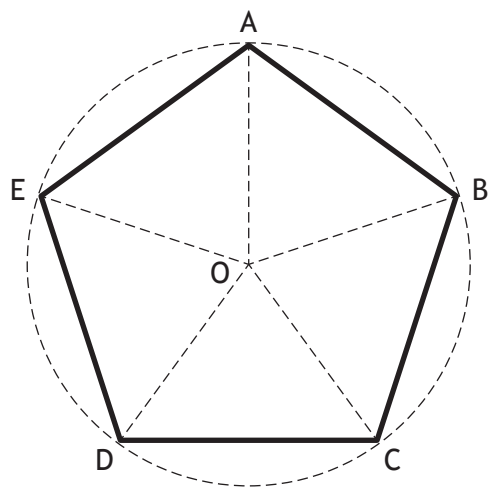
M is the midpoint of PR.

- (b) Express  $\vec{MQ}$  in component form.

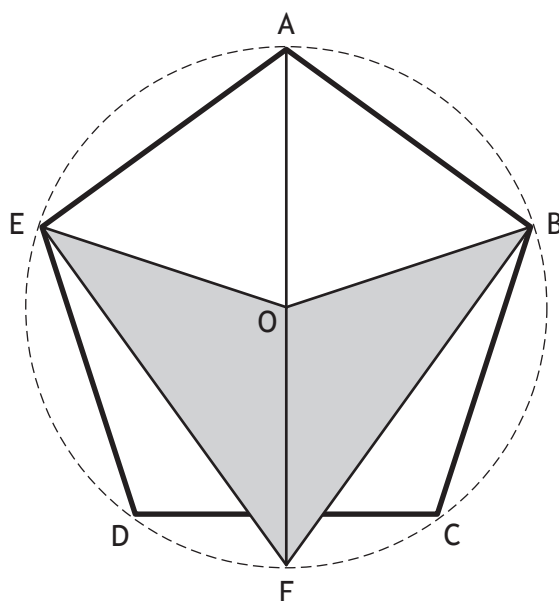
2



11. Pam is designing a company logo.  
 She starts by drawing a regular pentagon ABCDE.  
 The vertices of the pentagon lie on the circumference of a circle with centre O.



She then adds to the design as shown in the diagram below.



AF is a diameter of the circle.  
 Calculate the size of angle OFB.

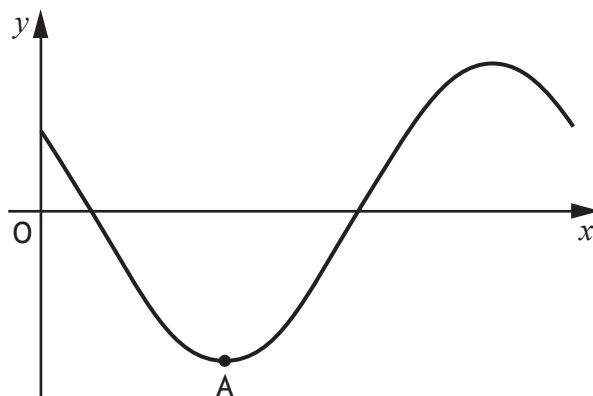
3



12. Express  $\frac{\sqrt{2}}{\sqrt{40}}$  as a fraction with a rational denominator.  
Give your answer in its simplest form.

3

13. Part of the graph of  $y = 3 \cos(x + 45)^\circ$  is shown in the diagram.



The graph has a minimum turning point at A.  
State the coordinates of A.

2



MARKS

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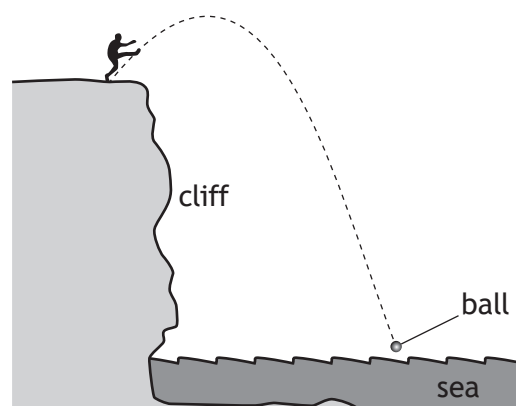
3

14. Solve the equation  $\frac{x}{2} - 1 = \frac{3-x}{5}$ .



\* X 8 4 7 7 5 0 1 1 3 \*

15. A ball is kicked from a clifftop.



The height,  $h$  metres, of the ball relative to the clifftop after  $t$  seconds is given by  $h = 12t - 5t^2$ .

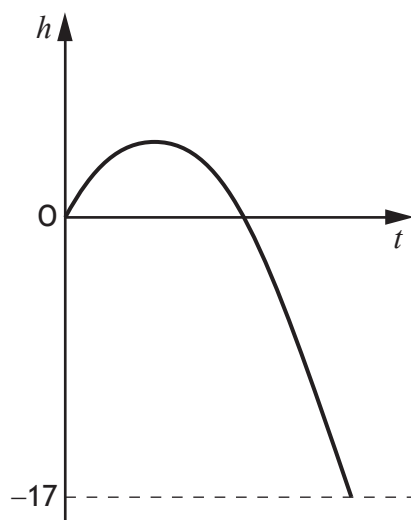
- (a) Calculate the height of the ball above the clifftop after 2 seconds.

1



15. (continued)

The graph below represents the height,  $h$  metres, of the ball relative to the clifftop after  $t$  seconds.



The sea is 17 metres below the clifftop.

(b) After how many seconds will the ball hit the sea?

4

[END OF QUESTION PAPER]



MARKS

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**X847/75/02**

**Mathematics  
Paper 2**

FRIDAY, 3 MAY

10:45 AM – 12:35 PM



\* X 8 4 7 7 5 0 2 \*

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Full name of centre

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Surname

Number of seat

Date of birth

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\* X 8 4 7 7 5 0 2 0 2 \*

Total marks — 60  
 Attempt ALL questions

1. A charity distributed 80 000 emergency packages during 2018.

This number is expected to increase by 15% each year.

Calculate how many emergency packages the charity expects to distribute in 2021.

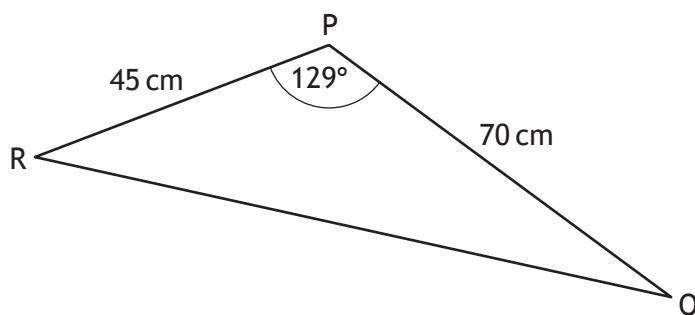
3

2. Find  $|\mathbf{p}|$ , the magnitude of vector  $\mathbf{p} = \begin{pmatrix} 6 \\ 27 \\ -18 \end{pmatrix}$ .

2



3. The diagram shows triangle PQR.



- PR = 45 centimetres
- PQ = 70 centimetres
- Angle QPR = 129°

Calculate the area of triangle PQR.

2

4. A sesame seed weighs  $3.6 \times 10^{-6}$  kilograms.

The weight of a poppy seed is 8% of the weight of a sesame seed.

Calculate the weight of a poppy seed in kilograms.

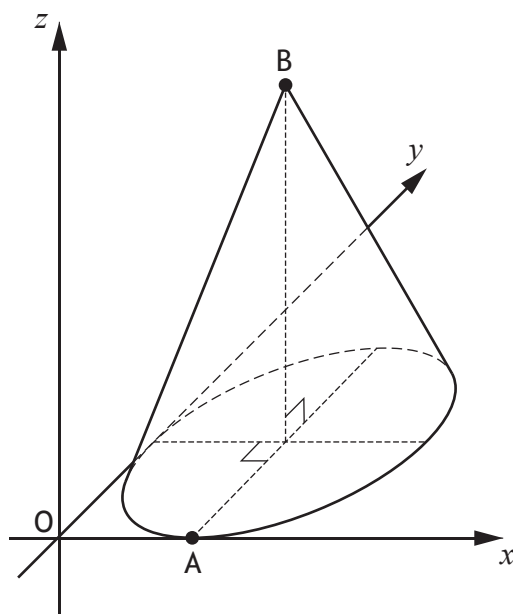
Give your answer in scientific notation.

2





5. The diagram shows a cone with diameter 6 units and height 8 units.



- The  $x$ -axis and the  $y$ -axis are tangents to the base
- A is the point of contact between the base and the  $x$ -axis
- B is directly above the centre of the base

Write down the coordinates of A and B.

2



MARKS

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6. Solve the equation  $3x^2 + 9x - 2 = 0$ .  
Give your answers correct to 1 decimal place.

3

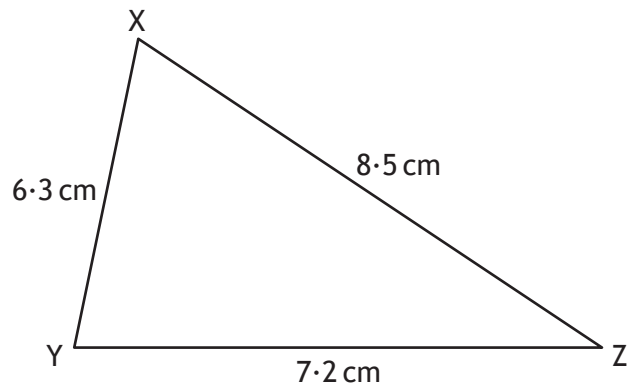


\* X 8 4 7 7 5 0 2 0 6 \*

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7. Triangle XYZ is shown below.



Calculate the size of the smallest angle in triangle XYZ.

3



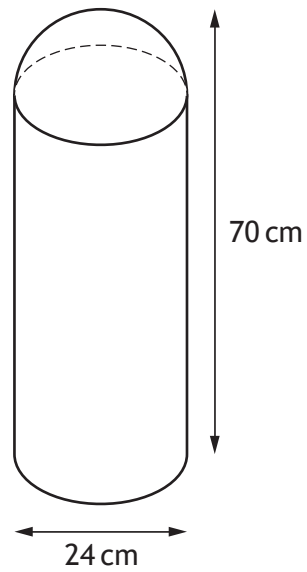
MARKS

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8. A traffic bollard is in the shape of a cylinder with a hemisphere on top.

The bollard has

- diameter 24 centimetres
- height 70 centimetres.



Calculate the volume of the bollard.

Give your answer correct to 3 significant figures.

5



MARKS

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9. Georgie had her roof repaired.  
She was charged an extra 2.5% for late payment.  
She had to pay a total of £977.85.  
Calculate how much she would have saved if she had paid on time.

3

10. Express  $x^2 + 10x - 15$  in the form  $(x + p)^2 + q$ .

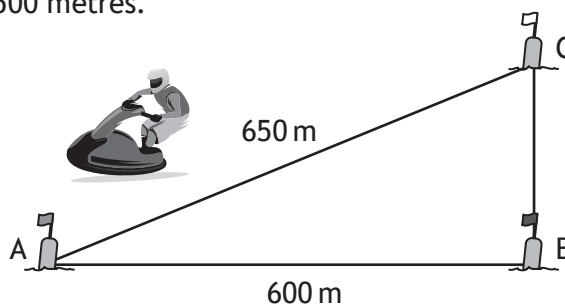
2



\* X 8 4 7 7 5 0 2 0 9 \*

11. The diagram shows the course for a jet-ski race.  
The course is indicated by markers A, B and C.  
The total length of the course is 1500 metres.

- B is 600 metres from A
- C is 650 metres from A
- C is due north of B



Determine whether B is due east of A.

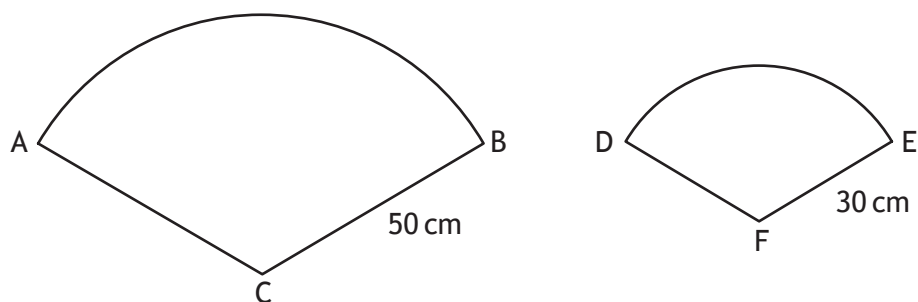
Justify your answer.

4



12. In the diagram

- ABC is a sector of a circle, centre C
- DEF is a sector of a circle, centre F.



The sectors are mathematically similar.

The area of the larger sector, ABC, is 2750 square centimetres.

(a) Calculate the area of the smaller sector, DEF.

3

(b) Calculate the size of angle ACB.

3



MARKS

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13. Find an expression for the gradient of the line joining point A(6,9) to point B(4p,4p<sup>2</sup>).  
Give your answer in its simplest form.

3

14. Solve the equation  $5\cos x^\circ + 2 = 1$ ,  $0 \leq x < 360$ .

3



\* X 8 4 7 7 5 0 2 1 2 \*



MARKS

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15. Express

$$\frac{4}{x-2} - \frac{3}{x+5}, \quad x \neq 2, x \neq -5$$

as a single fraction in its simplest form.

3

16. Simplify  $\frac{a^4 \times 3a}{\sqrt{a}}$ .

3



\* X 8 4 7 7 5 0 2 1 3 \*

17. Expand and simplify

$$(\sin x^\circ + \cos x^\circ)^2.$$

Show your working.

2

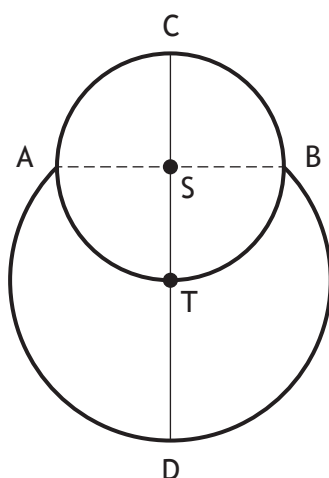


\* X 8 4 7 7 5 0 2 1 4 \*

18. The picture shows a cartoon snowman.



The diagram below represents the snowman.



- The head is a small circle, centre  $S$ , with diameter 15 centimetres
- The body is part of a larger circle, centre  $T$
- The point  $T$  lies on the circumference of the small circle
- The points  $A$  and  $B$  lie on the circumferences of both circles

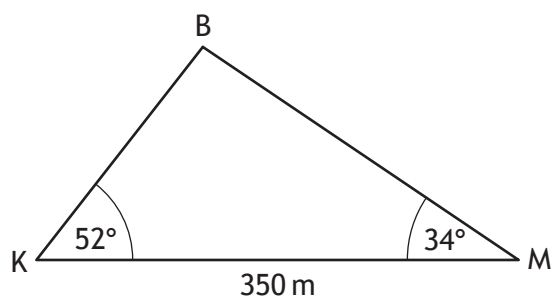
Calculate  $CD$ , the height of the snowman.

4



19. Katy and Mona are looking up at a hot-air balloon.

In the diagram below, K, M and B represent the positions of Katy, Mona and the balloon respectively.



- The angle of elevation of the balloon from Katy is  $52^\circ$
- The angle of elevation of the balloon from Mona is  $34^\circ$
- Katy and Mona are 350 metres apart on level ground

Calculate the height of the hot-air balloon above the ground.

5

[END OF QUESTION PAPER]



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