



National  
Qualifications  
2019

**X847/75/02**

**Mathematics  
Paper 2**

FRIDAY, 3 MAY

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**INSTRUCTIONS TO CANDIDATES**

Candidates should enter their surname, forename(s), date of birth, Scottish candidate number and the name and Level of the subject at the top of their first answer sheet.

**Total marks — 60**

Attempt ALL questions.

**You may use a calculator.**

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

State the units for your answer where appropriate.

Write your answers clearly on your answer sheet.

Questions marked with an asterisk differ in some respects from those in the printed paper.

Marks are shown in square brackets at the end of each question or part question.

An OW in the margin indicates a new question.

A separate formulae sheet is provided.

## 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.

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 marks]

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

- \* 3. Refer to the diagram for Question 3. The diagram shows triangle PQR.
- PR = 45 centimetres
  - PQ = 70 centimetres
  - Angle QPR =  $129^\circ$

Calculate the area of triangle PQR. [2 marks]

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 marks]

- \* 5. A cone with diameter 6 units and height 8 units is relative to the coordinate axes. The x-axis is tangent to the base at point A. The y-axis is tangent to the base at point D. C is the centre of the base. Angle ACD is a right angle. B is the top of the cone, directly above C. Angle ACB is a right angle.  
Write down the coordinates of A and B. [2 marks]

6. Solve the equation  $3x^2 + 9x - 2 = 0$ .

Give your answers correct to 1 decimal place. **[3 marks]**

\* 7. Refer to the diagram for Question 7. The diagram shows triangle XYZ.

Calculate the size of the smallest angle in triangle XYZ. **[3 marks]**

\* 8. Refer to the diagram for Question 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]**

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 marks]**

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

\*11. Refer to the diagram for Question 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 marks]**

**\*12.** Refer to the diagram for Question 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 marks]

(b) Calculate the size of angle ACB. [3 marks]

**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 marks]

**14.** Solve the equation  $5\cos x^\circ + 2 = 1$ ,  $0 \leq x < 360$ . [3 marks]

**\*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 marks]

**16.** Simplify  $\frac{a^4 \times 3a}{\sqrt{a}}$ . [3 marks]

**\*17.** Expand and simplify

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

Show your working. [2 marks]

**\*18.** Refer to the diagram for Question 18. The diagram represents a cartoon 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 marks]**

**\*19.** Refer to the diagram for Question 19. Katy and Mona are looking up at a hot-air balloon.

In the diagram,  $K$ ,  $M$  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 marks]**

**[END OF QUESTION PAPER]**