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H

National Qualifications

2022

Mathematics

Paper 1 (Non-calculator)

Friday, 6 May

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 – 55

Attempt ALL Questions

You must NOT use a calculator.

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

State the units for your answer where appropriate.

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

Tactile diagrams are produced in a separately bound booklet.

You must clearly identify the question number you are attempting on your answer sheet.

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

An ow in the margin indicates a new question.

[Braille page 2] A separate formula sheet is provided.

[Braille page 3] Total marks — 55

Attempt ALL questions

ow 1. Determine the equation of the line perpendicular to $5x+2y = 7$, passing through $(-1, 6)$. [3 marks]

ow 2. Evaluate $2\ log_3 6 - log_3 4$. [3 marks]

ow 3. A function, h, is defined by $h(x) = 4+(1/3)\ x$, where $x \in \mathbb{R}$.
Find the inverse function, $h^{-1}(x)$. [3 marks]

ow 4. Differentiate $y = \sqrt{x^3} - 2x^{-1}$, where $x > 0$. [3 marks]

ow * 5. Refer to the diagram for Question 5. A line makes an angle of $\pi/3$ radians with the y-axis, and passes through the point $(-2, 0)$ as shown in the diagram.
Determine the equation of the line. [3 marks]

ow 6. Evaluate $\int_{-5}^{2} (10-3x)^{-½}\ dx$. [4 marks]

ow *7. Refer to the diagram for Question 7. Triangles ABC and ADE are both right angled.
Angle BAC = q and angle DAE = r as shown in the diagram.

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ow 7. (a) Determine the value of:

(i) $sin\ r$ [1 mark]

(ii) $\sin q$. [1 mark]

ow 7. (b) Hence determine the value of $sin\ (q-r)$. [3 marks]

ow 8. Solve $log_6 x + \log_6 (x+5) = 2$, where $x > 0$. [4 marks]

ow 9. Solve the equation $cos2x^\circ = 5cos\, x^\circ - 3$ for $0 \leq x < 360$. [5 marks]

ow *10. Refer to the diagram for question 10. The diagram shows the graph of a cubic function with equation $y = f(x)$.

The curve has stationary points at (0, 3) and (4, 0).

ow 10. (a) Describe the transformations of $y = f(x)$ to $y = 2f(x) + 1$, and write the coordinates of the turning points. [3 marks]

Use the diagram provided.

ow 10. (b) State the coordinates of the stationary points on the graph of $y = f(\frac{1}{2}x)$. [1 mark]

ow 11. Express $2x^2 + 12x + 23$ in the form $p(x+q)^2 + r$. *[3 marks]*

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ow 12. Given that $f(x) = 4sin(3x - (\pi/3))$, evaluate $f'(\pi/6)$. [3 marks]

ow *13. Refer to the diagram for Question 13.

ow 13. (a) (i) Show that $(x+2)$ is a factor of $f(x) = x^3 - 2x^2 - 20x - 24$. [2 marks]

ow 13. (a) (ii) Hence, or otherwise, solve $f(x) = 0$. [3 marks]

The diagram shows the graph of $y = f(x)$.

ow 13. (b) The graph of $y = f(x-k)$, $k > 0$ has a stationary point at (1, 0).

State the value of k. [1 mark]

ow 14. C_1 is the circle with equation $(x-7)^2 + (y+5)^2 = 100$

ow 14. (a) (i) State the centre and radius of C_1. [2 marks]

(ii) Hence, or otherwise, show that the point P(−2, 7) lies outside C_1. [2 marks]

C_2 is a circle with centre P and radius r.

ow 14. (b) Determine the value(s) of r for which circles C_1 and C_2 have exactly one point of **[Braille page 6]** intersection. [2 marks]

[END OF QUESTION PAPER]