



SHORE

Examination Number:

Set:

Year 11

Mathematics

Preliminary Task 4

Yearly Examination

September 2017

General instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black pen
- NESAs-approved calculators may be used
- In Questions 11–14, show relevant mathematical reasoning and/or calculations
- Write your examination number on the front cover of each booklet to be handed in
- If you do not attempt a question, submit a blank booklet marked with your examination number and “N/A”
- A NESAs Reference Sheet is provided

Total marks – 70

Section I

Pages 2–5

10 marks

- Attempt Questions 1–10
- Allow about 15 minutes for this section

Section II

Pages 6–10

60 marks

- Attempt Questions 11–14
- Allow about 1 hour and 45 minutes for this section

Note: Any time you have remaining should be spent revising your answers.

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Section I

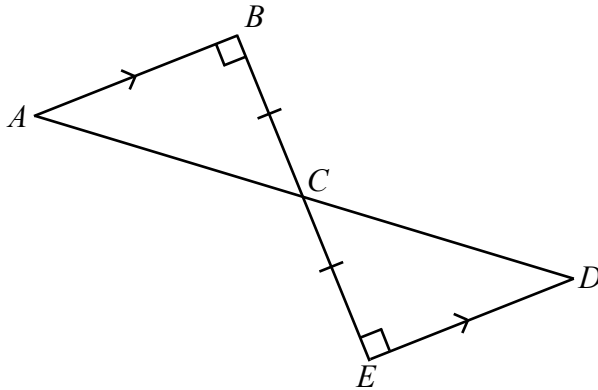
10 marks

Attempt Questions 1–10

Allow about 15 minutes for this section

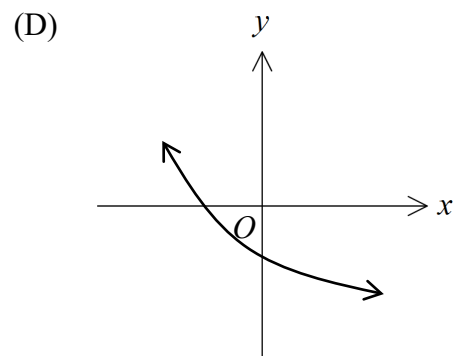
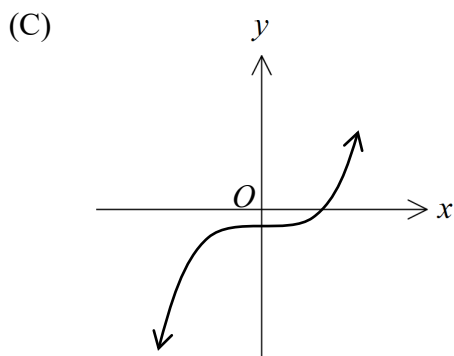
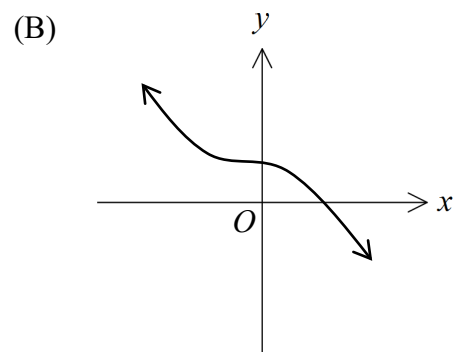
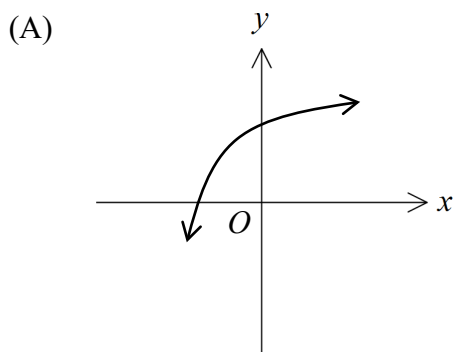
Use the multiple-choice answer sheet for Questions 1 – 10.

- 1 Which test would prove $\triangle ABC \equiv \triangle DEC$?



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- (A) SSS
(B) AAS
(C) RHS
(D) SAS
- 2 A function has $f'(x) < 0$ and $f''(x) > 0$ for all values of x .
Which of the following could be the graph of $y = f(x)$?



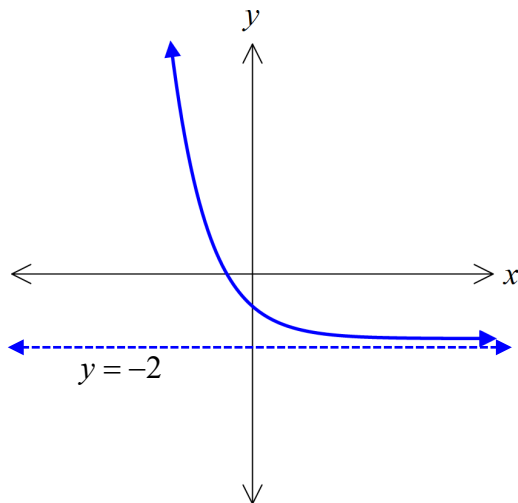
3 Which of the following is equivalent to $(x-3)(x+6) - (x-3)(x+3)$?

- (A) $3x-9$
- (B) $9x-9$
- (C) $3x-27$
- (D) $9x-27$

4 What is the solution to $2x^2 - x - 6 > 0$?

- (A) $x > -\frac{3}{2}, x > 2$
- (B) $-\frac{3}{2} < x < 2$
- (C) $x < -\frac{3}{2}, x > 2$
- (D) $-\frac{3}{2} > x > 2$

5 What could be the equation of the exponential graph shown?

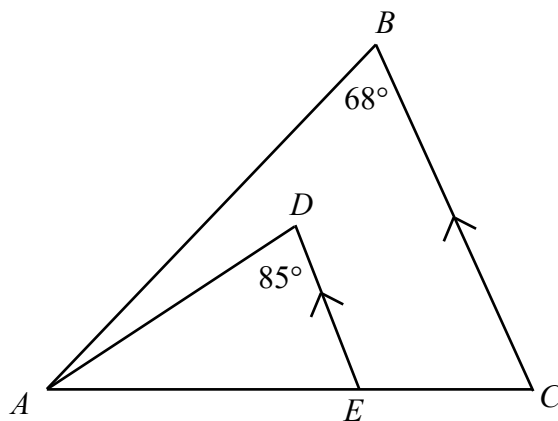


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- (A) $y = -3^x - 2$
- (B) $y = -2^x - 3$
- (C) $y = 2^{-x} - 3$
- (D) $y = 3^{-x} - 2$

- 6 What is the derivative of $(5x^3 + 1)^4$?
- (A) $4(5x^3 + 1)^3$
- (B) $20(5x^3 + 1)^3$
- (C) $60x^2(5x^3 + 1)^3$
- (D) $60x^3(5x^3 + 1)^3$
- 7 What is the perpendicular distance from the point $(2, -5)$ to the line $6x + 3y - 7 = 0$ in simplest surd form?
- (A) $\frac{2\sqrt{45}}{9}$
- (B) $\frac{2\sqrt{5}}{3}$
- (C) $2\sqrt{5}$
- (D) $\frac{10}{\sqrt{45}}$

- 8 In the diagram $AB = AC$ and $DE \parallel BC$.



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What is the size of $\angle BAD$?

- (A) 17°
- (B) 27°
- (C) 34°
- (D) 44°

- 9 What is the best description of the function $x^2 + 4x - 3$?
- (A) Positive definite
 - (B) Negative definite
 - (C) Positive indefinite
 - (D) Negative indefinite
- 10 How many solutions of the equation $(\cos 2x - 1)(\sin x + 1) = 0$ lie in the domain $0^\circ \leq x \leq 360^\circ$?
- (A) 3
 - (B) 4
 - (C) 5
 - (D) 6

Section II

60 marks

Attempt Questions 11–14

Allow about 1 hour and 45 minutes for this section

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

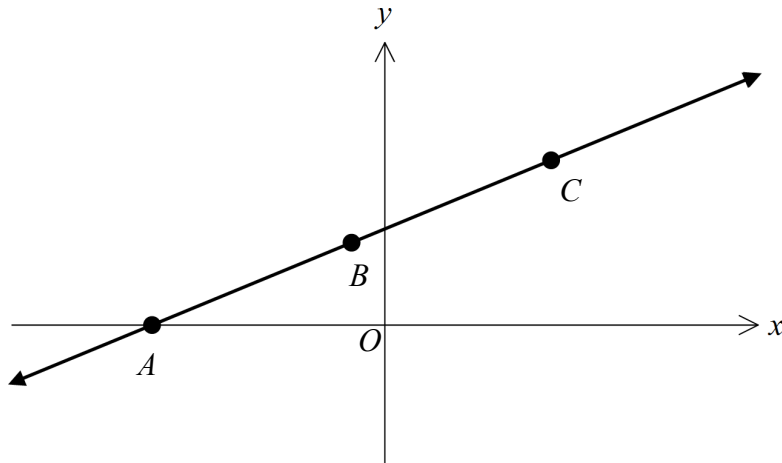
In Questions 11–14, your responses should include relevant mathematical reasoning and/or calculations.

Question 11 (15 marks) Use a SEPARATE writing booklet

- (a) Evaluate $\sqrt{\frac{3\pi^2 + 2}{5.2 \times 4.8}}$ correct to 2 significant figures. 1
- (b) Solve $|3x - 2| \leq 13$. 2
- (c) Fully factorise:
- (i) $2x^3 - 54$ 1
- (ii) $3x^3 + 5x^2 - 12x - 20$ 2
- (d) Differentiate $4x^{-2}$. 1
- (e) If $\cos \alpha = \frac{3}{4}$ and $\tan \alpha < 0$, find the exact value of $\sin \alpha$. 2
- (f) Simplify $\frac{3}{x-2} + \frac{1}{x}$. 2
- (g) Express $\frac{\sqrt{3}}{\sqrt{7}-2}$ with a rational denominator. 2
- (h) Solve $\sqrt{3} \tan \theta = 1$ for $0 \leq \theta \leq 360^\circ$. 2

Question 12 (15 marks) Use a SEPARATE writing booklet

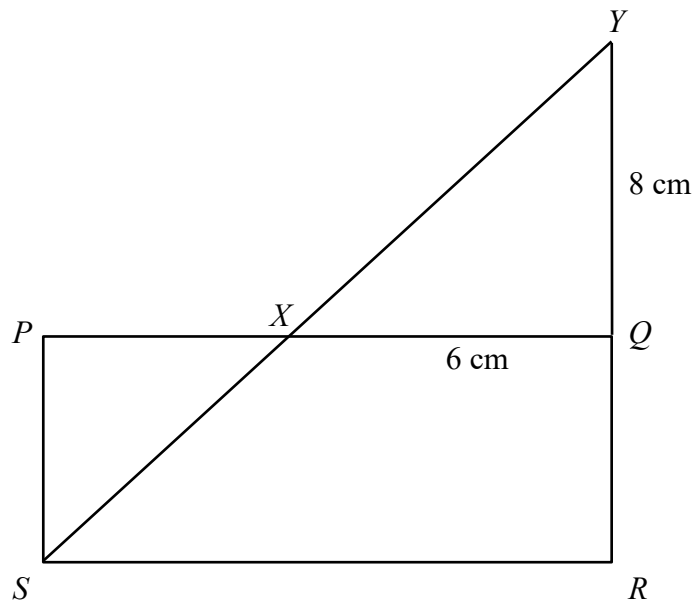
- (a) The diagram shows the points $A(-7, 0)$, $B(-1, 2)$ and $C(5, 4)$.



- (i) Find the gradient of line BC 1
- (ii) Find the coordinates of M , the midpoint of BC . 1
- (iii) Show that the equation of the perpendicular bisector of interval BC is $3x + y - 9 = 0$. 2
- (iv) The perpendicular bisector of BC meets the x -axis at D . Find the coordinates of D . 1
- (v) Hence, or otherwise, find the area of $\triangle ABD$. 1
- (b) Show that $\tan \theta - \sin \theta \cos \theta = \frac{\sin^3 \theta}{\cos \theta}$. 2
- (c) A function is defined as $f(x) = \frac{x^4 - 1}{x}$.
- (i) Evaluate $f(-2)$. 1
- (ii) Determine if the function $f(x)$ is odd, even or neither. 2

Question 12 continues on page 8

- (d) In the diagram $PQRS$ is a rectangle and $SR = 3PS$. R , Q and Y are collinear points. $XQ = 6$ cm and $YQ = 8$ cm.



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- (i) Prove $\triangle YQX \parallel \triangle YRS$. 2
- (ii) Hence, find the length of PS . 2

End of Question 12.

Question 13 (15 marks) Use a SEPARATE writing booklet

(a) The roots of the equation $2x^2 + 5x + 3 = 0$ are α and β .

(i) Find $\alpha + \beta$. 1

(ii) Find $\alpha\beta$. 1

(iii) Find $\frac{1}{\alpha^2} + \frac{1}{\beta^2}$. 2

(b) Differentiate:

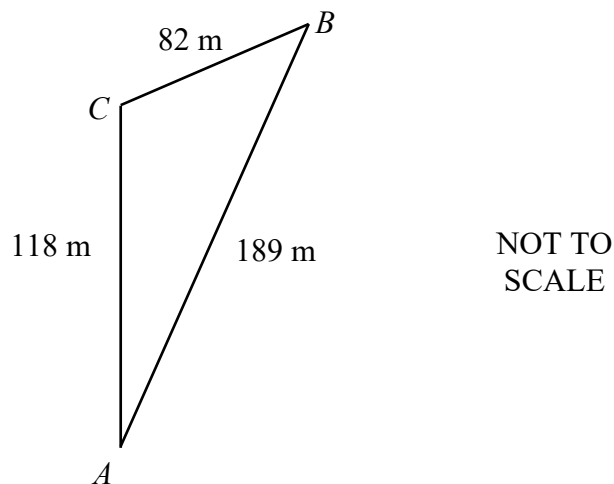
(i) $\frac{2}{\sqrt{x}}$ 1

(ii) $\frac{2x+1}{x-3}$ 2

(iii) $3x^2(x^3 - 7)^5$ 2

(c) Find the equation of the tangent to the curve $y = 4x^2 + 6x - 5$ at the point $(-3, 13)$. 2

(d) A park is bordered by three straight roads, AC , CB , and BA . The road AC runs due North.



Copy or trace the diagram into your writing booklet.

(i) Calculate the bearing of B from C , correct to the nearest degree. 3

(ii) Calculate the area of the park, correct to one decimal place. 1

Question 14 (15 marks) Use a SEPARATE writing booklet

(a) Express $3x^2 - 5x$ in the form $A(x-3)^2 + B(x+1) + C$, for integer values A, B and C . **3**

(b) Consider the function $f(x) = x^3 + 2x^2 - 15x$.

(i) Find the coordinates of the points where the curve crosses the axes. **2**

(ii) Find any stationary points on $y = f(x)$ and determine their nature. **4**

(iii) Sketch the curve labelling all features identified above. **1**

(iv) Hence, or otherwise, determine the values of x for which $y = f(x)$ is increasing. **1**

(c) A circle has equation $(x-2)^2 + y^2 = 20$.

(i) Show that where the line $y = 2x + k$ intersects the circle is given by **2**
 $5x^2 + (4k - 4)x + k^2 - 16 = 0$.

(ii) Find the values of k for which the line $y = 2x + k$ is a tangent to the circle. **2**

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