The Scots College

Name: _____

Teacher: _____

2022

Year 10 Assessment Task 4

Friday 28th October

Mathematics 5.3

Weighting: 40%
Total marks: 80

General Instructions

- Reading time – 5 minutes
- Working time – 90 minutes
- Write using black pen
- Calculators approved by NESA may be used
- A multiple choice sheet is provided separately
- Show mathematical reasoning and/or calculations in Sections II - IV

Multiple Choice	
Section II	
Section III *Trigonometry*	
Section III *Probability*	
Section IV	
Total	

Section I – 8 marks (pages 3–6)
- Attempt Question 1– 8
- Allow about 10 minutes for this section
- Answer on the multiple choice sheet provided

Section II – 23 marks (pages 7–12)
- Attempt Questions 9–17
- Allow about 25 minutes for this section

Section III – 27 marks (pages 13-19)
- Attempt Questions 18–25
- Allow about 30 minutes for this section

Section IV – 22 marks (pages 21-26)
- Attempt Questions 26–32
- Allow about 25 minutes for this section

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Section I

8 marks
Attempt Questions 1–8.
Allow about 10 minutes for this section.

Use the multiple-choice answer sheet for Questions 1 – 8.

---

1 If $x = 6y^2$, what is a possible value of y when $x = 2400$?

A. 0.05

B. 20

C. 120

D. 400

2 What is the slope of the line with equation $2x - 4y + 3 = 0$?

A. -2

B. -0.5

C. 0.5

D. 2

3 What is $(16m^4n^{100})^{\frac{1}{2}}$ fully simplified?

A. $4m^2n^{10}$

B. $4m^2n^{50}$

C. $8m^2n^{10}$

D. $8m^2n^{50}$

4 What is the solution to $3x + 1 > 5x + 9$?

A. $x > -4$

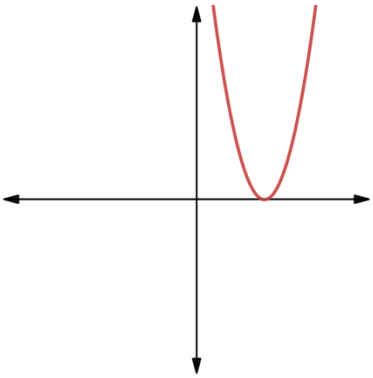
B. $x > 4$

C. $x < -4$

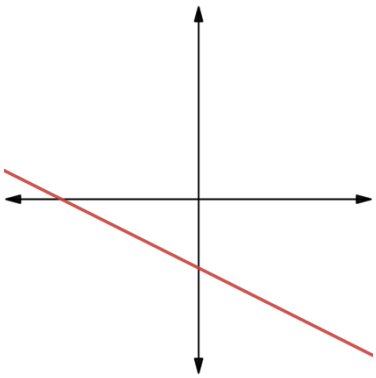
D. $x < 4$

5 Which of the following is NOT a function?

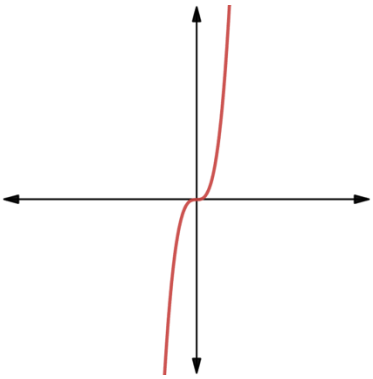
A.



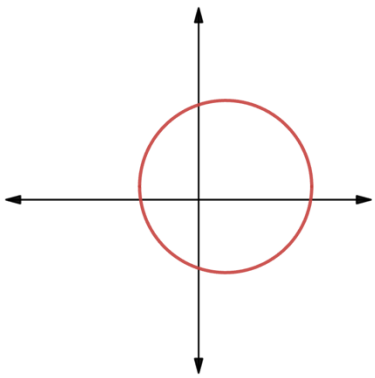
B.



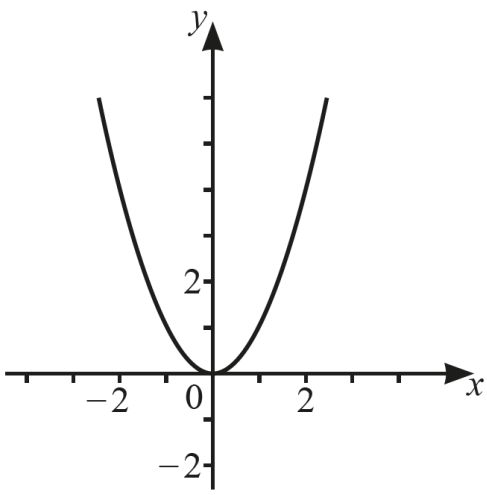
C.



D.

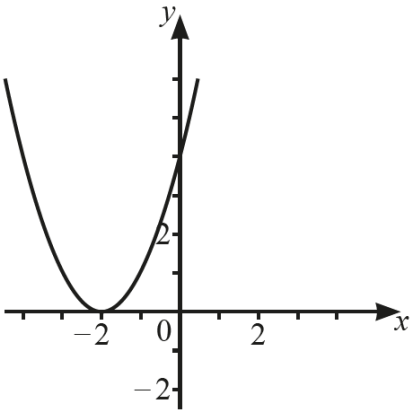


6 The diagram shows the graph of $y = f(x)$.

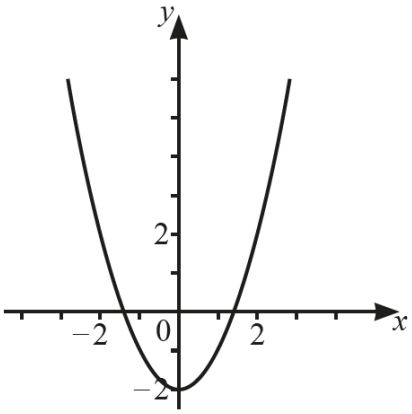


Which of the diagrams below represents $y = f(x + 2)$?

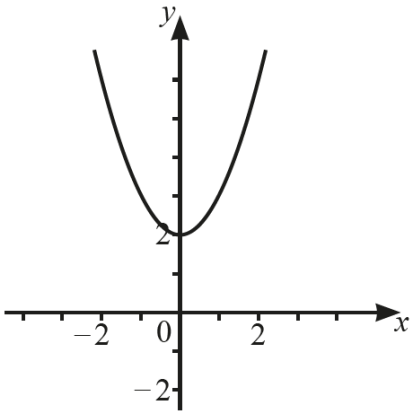
A.



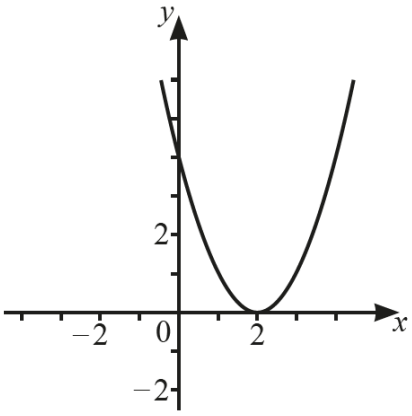
B.



C.



D.



7 What are the two asymptotes of the hyperbola $y = \frac{1}{x-2} + 3$?

A. $x = -2, y = 3$

B. $x = -2, y = -3$

C. $x = 2, y = 3$

D. $x = 2, y = -3$

8 What are the solutions of $3x^2 + 2x = 4$?

A. $x = -1 \pm \sqrt{5}$

B. $x = \frac{-1 \pm \sqrt{3}}{3}$

C. $x = \frac{-1 \pm \sqrt{11}}{3}$

D. $x = \frac{-1 \pm \sqrt{13}}{3}$

END OF SECTION

Year 10 Assessment Task 4

Mathematics 5.3

Section II Answer Booklet

23 marks
Attempt Questions 9 - 17
Allow about 25 minutes for this section.

Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your response should include relevant mathematical reasoning and/or calculations.
- Extra writing space is provided at the end of this examination. If you use this space, clearly indicate which question you are answering

Please turn over

Question 9 (3 marks)

Simplify fully the following.

a) $\sqrt{18}$ **1**

b) $\sqrt{63} - 4\sqrt{7}$ **1**

c) $6\sqrt{5}(\sqrt{5} + 1)$ **1**

Question 10 (2 marks)

Rationalise the denominator of $\frac{4}{\sqrt{3}+1}$ giving your answer in simplified form. **2**

Question 11 (3 marks)

Solve $\frac{3y}{2y-1} = \frac{3}{4}$. **3**

Question 12 (2 marks)

Solve $x^2 - 2x - 8 = 0$ by factorising. **2**

Question 13 (2 marks)

Simplify $\frac{15c^4d}{12c^{-2}\,d^{-3}}$, leaving your answer in positive index form. **2**

Question 14 (3 marks)

Write $\frac{4}{x-1} - \frac{3}{x+2}$ as a single fraction in simplest form. **3**

Question 15 (3 marks)

Simplify $\frac{2x^2-8}{2x^2+x-10}$ fully. **3**

Question 16 (2 marks)

Solve for x.

a) $\log_x 64 = 3$ **1**

b) $x = \log_5 \sqrt{5}$ **1**

Question 17 (3 marks)

Solve $4x + 2y = 10$ and $5x + 3y = 12$ simultaneously. **3**

END OF SECTION

Year 10 Assessment Task 4

Mathematics 5.3

Section III Answer Booklet

27 marks
Attempt Questions 18 - 25
Allow about 30 minutes for this section.

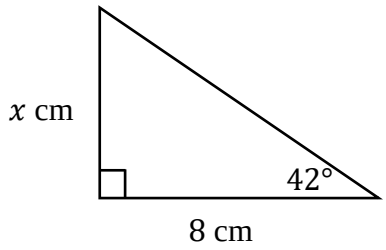
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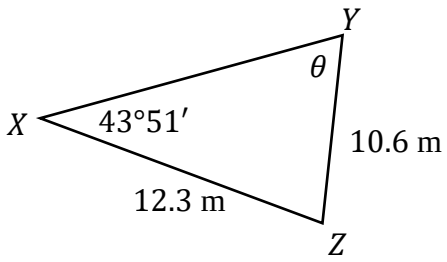
Question 18 (2 marks)

Find the value of x in the triangle below, correct to one decimal place. **2**



Question 19 (3 marks)

Find θ in triangle XYZ, correct to the nearest minute. **3**



Question 20 (3 marks)

A bird is sitting 21 metres above ground level, in a tree.

The bird spots a worm on the ground at an angle of depression of 19°.

a) Draw a fully labelled diagram to represent this information. **1**

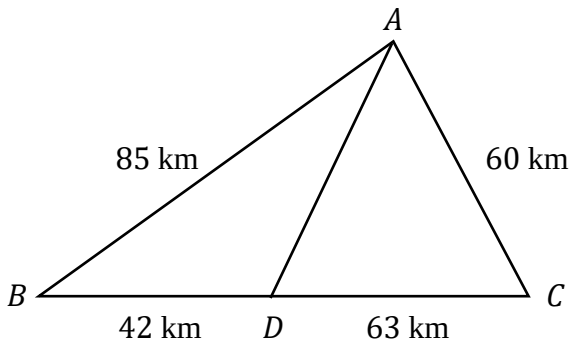
b) How far must the bird fly in a straight line to catch the worm, assuming the worm does not move, correct to the nearest metre? **2**

Question 21 (2 marks)

Find all values of x in the domain $0° \leq x \leq 360°$ for which $\cos x = -\frac{1}{2}$. **2**

Question 22 (4 marks)

Three towns A, B and C are joined by straight roads. A straight road also runs from A to D. These distances are represented in the diagram below.



4

Find the length of AD correct to one decimal place.

Question 23 (3 marks)

A farmer drives around the boundary of his farm land on his tractor. **3**

He starts at one of the corners and drives on a bearing of $040°$ for 65 metres.

From this point he drives his tractor on a bearing of $140°$ for another 75 metres before turning again to drive back his original starting point.

Calculate the area of his farm enclosed by this boundary, correct to two decimal places.

Question 24 (5 marks)

A card is selected at random from twelve cards which are numbered using the integers from 1 to 12. Numbers are not repeated. The elements of sets A and B are as follows:

$A = \{\text{cards with odd numbers}\}$

$B = \{\text{cards with numbers that are multiples of 3}\}$

a) Represent the two events A and B in a Venn diagram. **2**

b) Find $P(A \cap B)$. **1**

---

c) Find $P(\bar{A})$. **1**

---

d) Find $P(A|B)$. **1**

Question 25 (5 marks)

There are two prizes to be won in a raffle which has sold 60 tickets. The first prize is selected by drawing a ticket at random. This ticket IS NOT replaced for the draw for the second prize. Johnny has purchased two tickets for this raffle.

a) Draw a tree diagram to illustrate this situation. **2**

b) Find the probability that Johnny:

i. Wins both prizes. **1**

---

ii. Wins at least one prize. **2**

END OF SECTION

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Year 10 Assessment Task 4

Mathematics 5.3

Section IV Answer Booklet

25 marks
Attempt Questions 26 - 32
Allow about 30 minutes for this section.

Instructions

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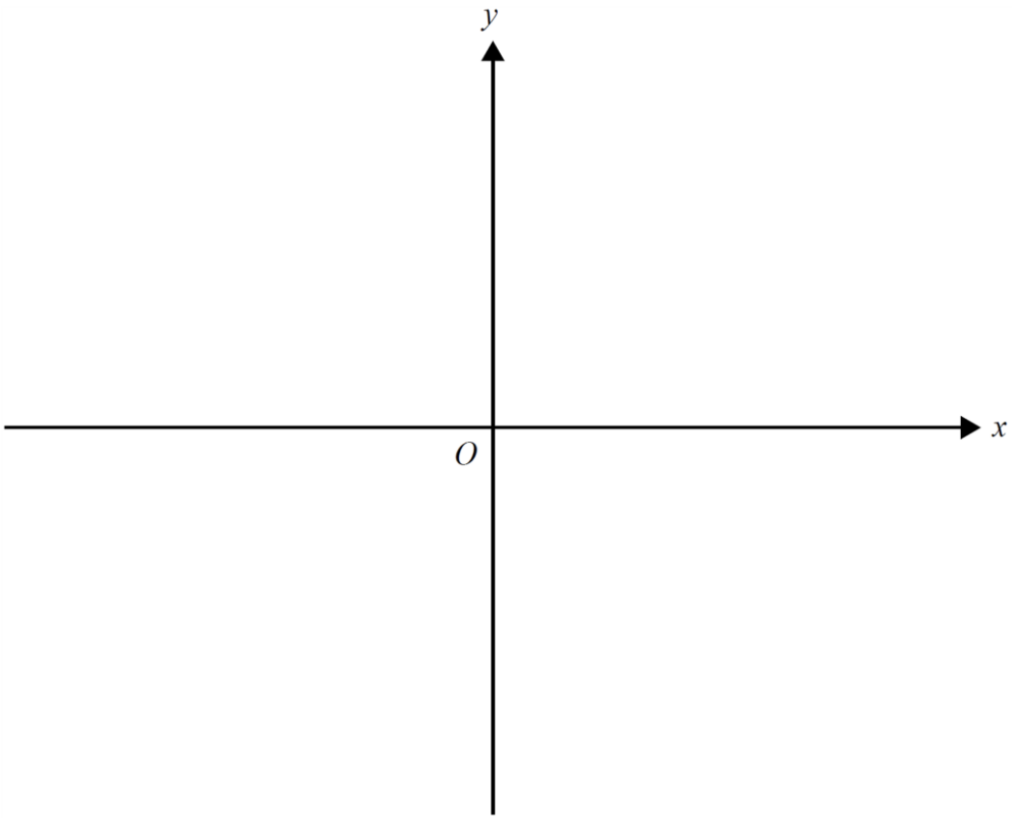
Please turn over

Question 26 (6 marks)

Consider the quadratic function $y = x^2 - 4x + 3$.

a) By completing the square, express $y = x^2 - 4x + 3$ in the form $y = (x - a)^2 - b$, where a and b are integers. **2**

b) Hence, sketch $y = x^2 - 4x + 3$ showing the axis intercepts and the vertex. **4**



Question 27 (5 marks)

Points A and B have coordinates $(-2, 1)$ and $(6, 13)$ respectively, and point M is the midpoint of AB. Find the equation of the line perpendicular to AB which passes through the point M, giving your answer in general form. **5**

Question 28 (1 marks)

Solve $2^x = 3$. Give your answer correct to three decimal places. **1**

Question 29 (2 marks)

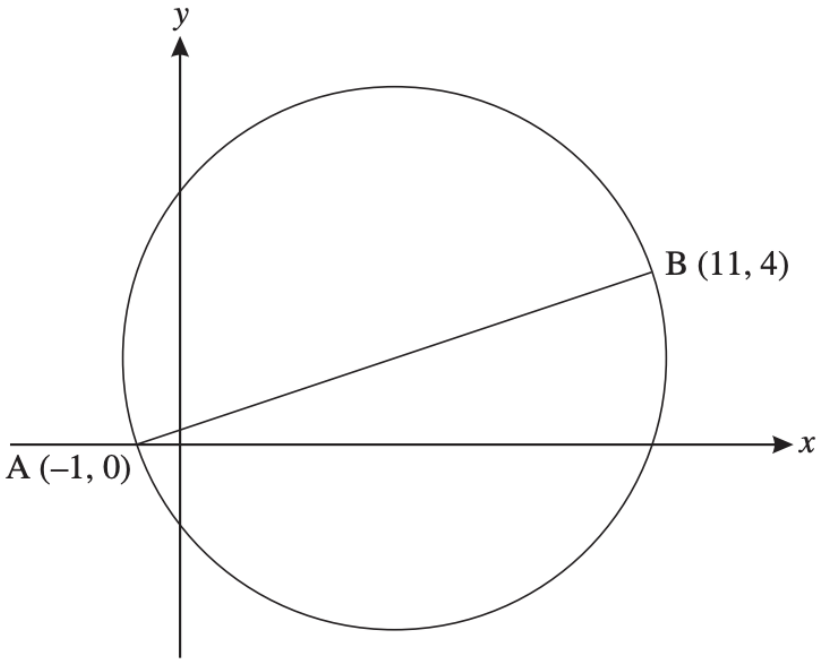
Find $f^{-1}(x)$ of $f(x) = \frac{2-x}{3}$. **2**

Question 30 (2 marks)

Solve $3^{4x+2} = 27^{3x}$. **2**

Question 31 (3 marks)

The diagram below shows a graph with the diameter AB, which have coordinates $(-1, 0)$ and $(11, 4)$ respectively. **3**



Find the equation of the graph giving your answer in the form $(x-a)^2+(y-b)^2=r^2$ where a, b and r are integers.

Question 32 (3 marks)

Solve $2\log_a x - \log_a(3x - 5) = \log_a 4$. **3**

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If you use this space, clearly indicate which question you are answering.

Additional writing space

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The Scots College

Name: SOLUTIONS

Teacher: _____

2022

Year 10 Assessment Task 4

Friday 28th October

Mathematics 5.3

Weighting: 40%
Total marks: 80

General Instructions

- Reading time – 5 minutes
- Working time – 90 minutes
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Section II	
Section III *Trigonometry*	
Section III *Probability*	
Section IV	
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Section I

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B. 20

C. 120

D. 400

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4 What is the solution to $3x + 1 > 5x + 9$?

A. $x > -4$

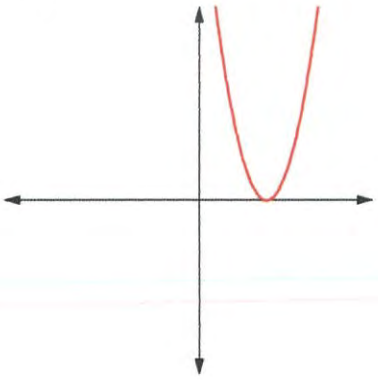
B. $x > 4$

C. $x < -4$

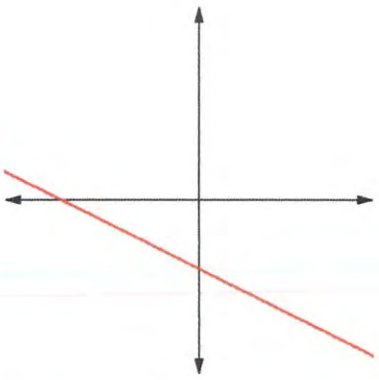
D. $x < 4$

5 Which of the following is NOT a function?

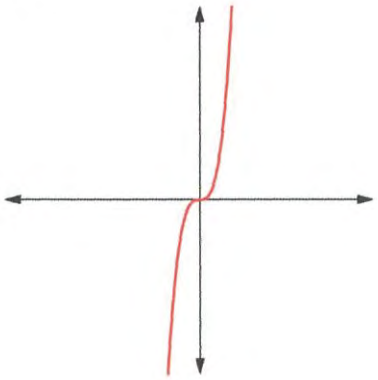
A.



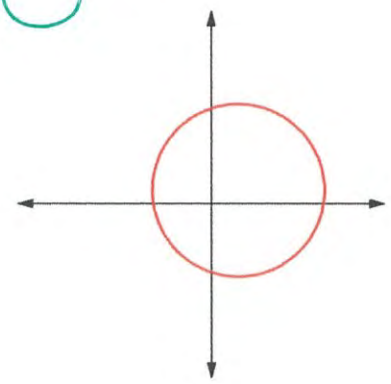
B.



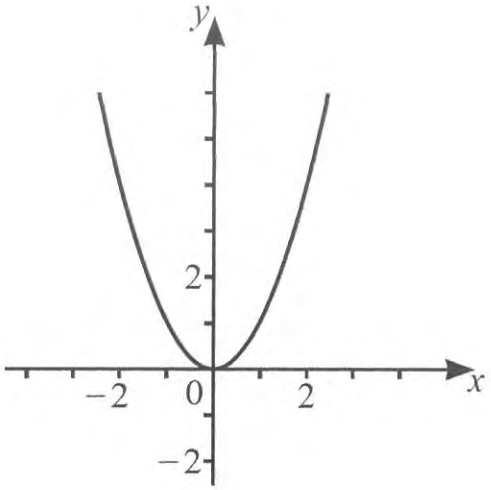
C.



D.

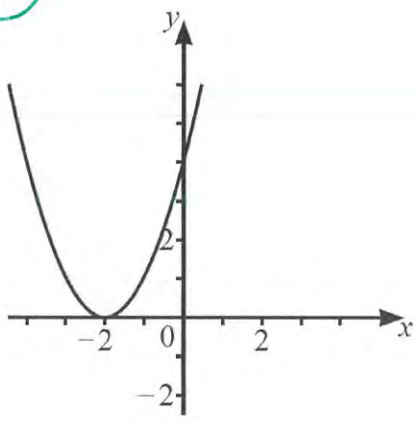


6 The diagram shows the graph of $y = f(x)$.

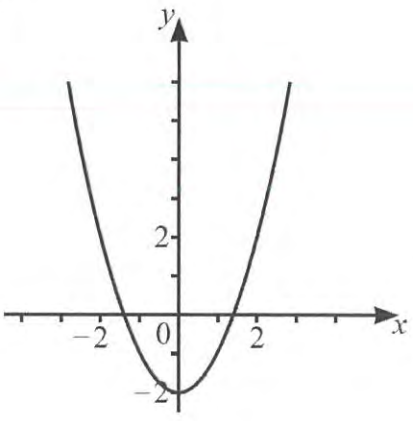


Which of the diagrams below represents $y = f(x + 2)$?

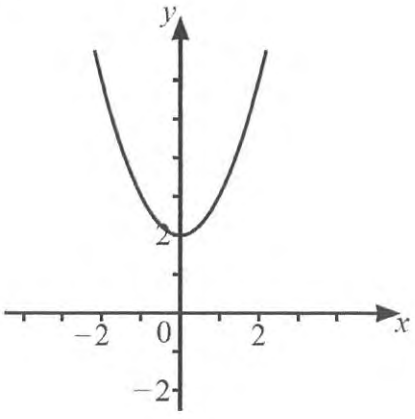
A.



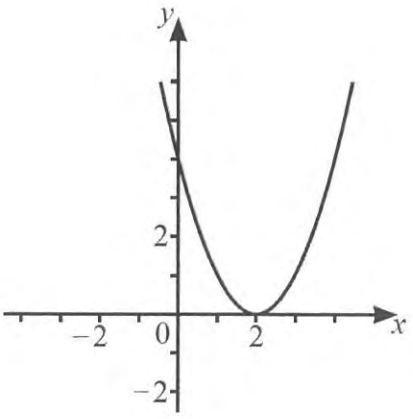
B.



C.



D.



7 What are the two asymptotes of the hyperbola $y = \frac{1}{x-2} + 3$?

A. $x = -2, y = 3$

B. $x = -2, y = -3$

C. $x = 2, y = 3$

D. $x = 2, y = -3$

8 What are the solutions of $3x^2 + 2x = 4$?

A. $x = -1 \pm \sqrt{5}$

B. $x = \frac{-1 \pm \sqrt{3}}{3}$

C. $x = \frac{-1 \pm \sqrt{11}}{3}$

D. $x = \frac{-1 \pm \sqrt{13}}{3}$

END OF SECTION

Year 10 Assessment Task 4

Mathematics 5.3

Section II Answer Booklet

23 marks
Attempt Questions 9 - 17
Allow about 25 minutes for this section.

Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
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Please turn over

Question 9 (3 marks)

Simplify fully the following.

a) $\sqrt{18}$ **1**

$= \sqrt{9} \times \sqrt{2}$

$= 3\sqrt{2}$ (1)

b) $\sqrt{63} - 4\sqrt{7}$ **1**

$= 3\sqrt{7} - 4\sqrt{7}$

$= -\sqrt{7}$ (1)

c) $6\sqrt{5}(\sqrt{5} + 1)$ **1**

$= 6 \times 5 + 6\sqrt{5}$

$= 30 + 6\sqrt{5}$

($\frac{1}{2}$) ($\frac{1}{2}$)

Question 10 (2 marks)

Rationalise the denominator of $\frac{4}{\sqrt{3}+1}$ giving your answer in simplified form. **2**

$\frac{4}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1}$ ($\frac{1}{2}$) $= \frac{4\sqrt{3}-4}{3-1}$ ($\frac{1}{2}$)

$= \frac{4\sqrt{3}-4}{2}$

$= 2\sqrt{3} - 2$ (1)

Question 11 (3 marks)

Solve $\frac{3y}{2y-1} = \frac{3}{4}$. **3**

$12y = 3(2y-1)$ (1)

$12y = 6y - 3$ (1)

$6y = -3$

$y = -\frac{1}{2}$ (1)

Question 12 (2 marks)

Solve $x^2 - 2x - 8 = 0$ by factorising. **2**

$(x-4)(x+2) = 0$

$x - 4 = 0$ $\qquad$ $x + 2 = 0$

$x = 4$ $\qquad$ $x = -2$

(1) $\qquad$ (1)

Question 13 (2 marks)

Simplify $\frac{15c^4d}{12c^{-2}d^{-3}}$, leaving your answer in positive index form. **2**

$= \frac{5c^6d^4}{4}$ $-\frac{1}{2}$ mark for each error.

Question 14 (3 marks)

Write $\frac{4}{x-1} - \frac{3}{x+2}$ as a single fraction in simplest form. **3**

$= \frac{4(x+2) - 3(x-1)}{(x-1)(x+2)}$ (1)

$= \frac{4x + 8 - 3x + 3}{(x-1)(x+2)}$ (1)

$= \frac{x + 11}{(x-1)(x+2)}$ (1)

Question 15 (3 marks)

Simplify $\frac{2x^2-8}{2x^2+x-10}$ fully. **3**

$= \frac{2(x^2-4)}{2x^2+5x-4x-10}$

$= \frac{2(x-2)(x+2)}{(2x+5)(x-2)}$ (1) (1)

$= \frac{2(x+2)}{2x+5}$ (1)

Question 16 (2 marks)

Solve for x.

a) $\log_x 64 = 3$ **1**

$x^3 = 64$

$x^3 = 4^3$

$\therefore x = 4$ (1)

b) $x = \log_5 \sqrt{5}$ **1**

$5^x = \sqrt{5}$

$5^x = 5^{\frac{1}{2}}$

$\therefore x = \frac{1}{2}$ (1)

Question 17 (3 marks)

Solve $4x + 2y = 10$ and $5x + 3y = 12$ simultaneously. **3**

$4x + 2y = 10 \times 5$
$5x + 3y = 12 \times 4$

$20x + 10y = 50$ (1)
$20x + 12y = 48$ (2)

(2) − (1)

$2y = -2$

$y = -1$ (1)

sub $y = -1$ into (1)

$4x + 2(-1) = 10$

$4x = 12$

$x = 3$ (1)

or

$4x + 2y = 10 \times 3$
$5x + 3y = 12 \times 2$

$12x + 6y = 30$ (1)
$10x + 6y = 24$ (2)

(1) − (2)

$2x = 6$

$x = 3$ (1)

sub $x = 3$ into (1)

$4(3) + 2y = 10$

$12 + 2y = 10$

$2y = -2$

$y = -1$ (1)

END OF SECTION

Year 10 Assessment Task 4

Mathematics 5.3

Section III Answer Booklet

27 marks
Attempt Questions 18 - 25
Allow about 30 minutes for this section.

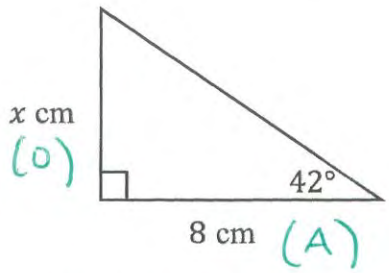
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Question 18 (2 marks)

Find the value of x in the triangle below, correct to one decimal place. **2**



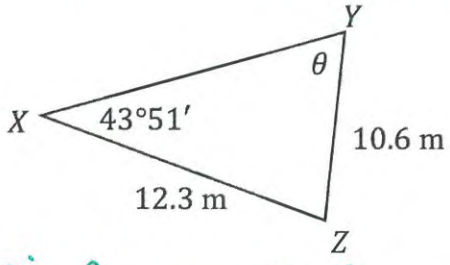
$\tan 42° = \frac{x}{8}$ (1)

$x = 8 \times \tan 42°$

$= 7.2\text{cm}$ (1)

Question 19 (3 marks)

Find θ in triangle XYZ, correct to the nearest minute. **3**



$\frac{\sin A}{a} = \frac{\sin B}{b}$

$\frac{\sin\theta}{12.3} = \frac{\sin 43°51'}{10.6}$ (1)

$\sin\theta = \frac{12.3 \sin 43°51'}{10.6}$

$\theta = \sin^{-1}(0.803877\ldots)$ (1)

$= 53.5020\ldots$

$\theta = 53°30'$ (1)

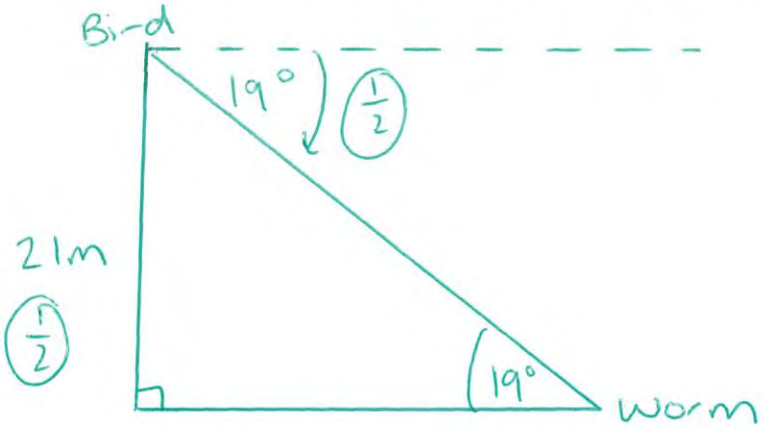
Rounding mark here

Question 20 (3 marks)

A bird is sitting 21 metres above ground level, in a tree.

The bird spots a worm on the ground at an angle of depression of 19°.

a) Draw a fully labelled diagram to represent this information. **1**



b) How far must the bird fly in a straight line to catch the worm, assuming the worm does not move, correct to the nearest metre? **2**

$\sin 19° = \frac{21}{x}$ (1)

$x = \frac{21}{\sin 19°}$

$= 65m$ (1)

Question 21 (2 marks)

Find all values of x in the domain $0° \leq x \leq 360°$ for which $\cos x = -\frac{1}{2}$. **2**

$\cos 60 = \frac{1}{2}$

But cos is negative in the 2nd & 3rd quadrant

$\therefore x = 120°$ and $240°$

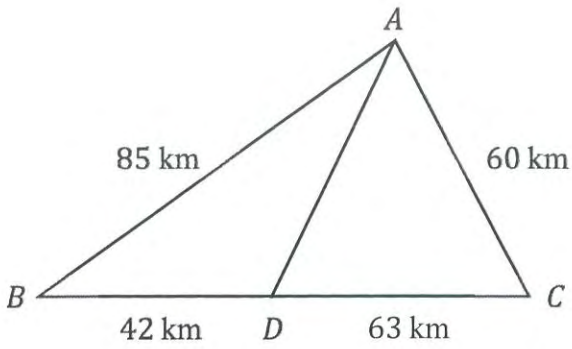
(1) mark 120°/240°

(½) mark for correct working towards second angle

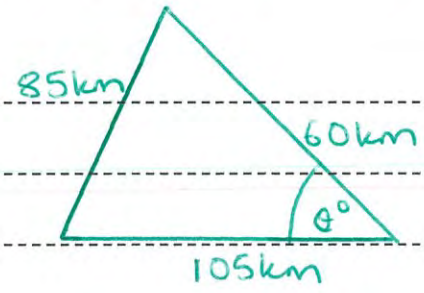
(½) second correct angle.

Question 22 (4 marks)

Three towns A, B and C are joined by straight roads. A straight road also runs from A to D. These distances are represented in the diagram below. **4**



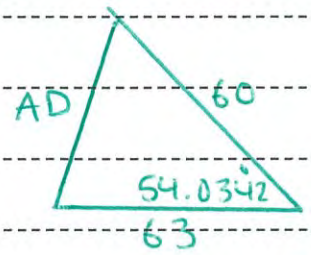
Find the length of AD correct to one decimal place.



$\cos\theta = \frac{105^2 + 60^2 - 85^2}{2 \times 105 \times 60}$ (1)

$= \frac{37}{63}$

$\theta = 54.0342...$ (1)

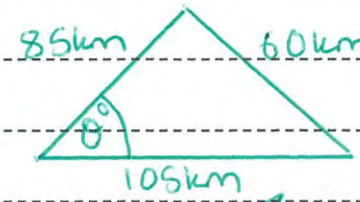


$AD^2 = 63^2 + 60^2 - 2 \times 63 \times 60 \times \cos 54.$ (1)

$= 3128.9950...$

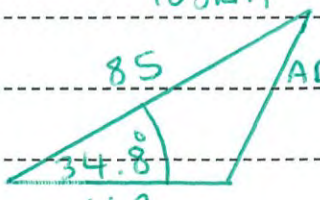
$\therefore AD = 55.9\text{km}$ (1)

or



$\cos\theta = \frac{85^2 + 105^2 - 60^2}{2 \times 85 \times 105}$ (1)

$\theta = 34.8$ (1)



$AD^2 = 85^2 + 42^2 - 2 \times 85 \times 42 \times \cos 34.8°$ (1)

$= 3129$

$\therefore AD = 55.9\text{km}$ (1)

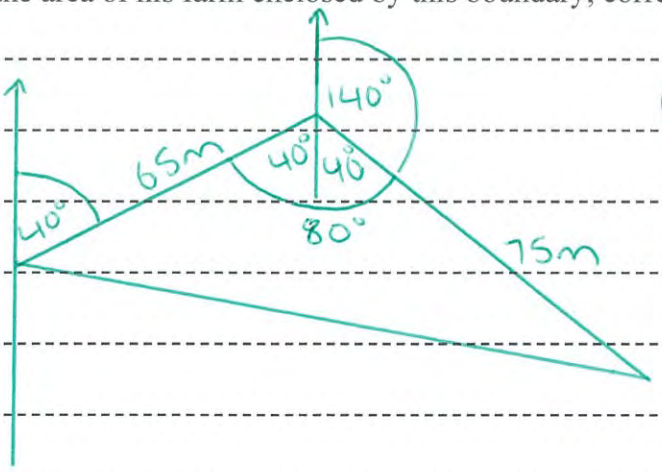
Question 23 (3 marks)

A farmer drives around the boundary of his farm land on his tractor. **3**

He starts at one of the corners and drives on a bearing of 040° for 65 metres.

From this point he drives his tractor on a bearing of 140° for another 75 metres before turning again to drive back his original starting point.

Calculate the area of his farm enclosed by this boundary, correct to two decimal places.



① → Finding angle of 80°

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

$= \frac{1}{2} \times 65 \times 75 \times \sin 80$ ①

$= 2400.47 m^2$ ①

Question 24 (5 marks)

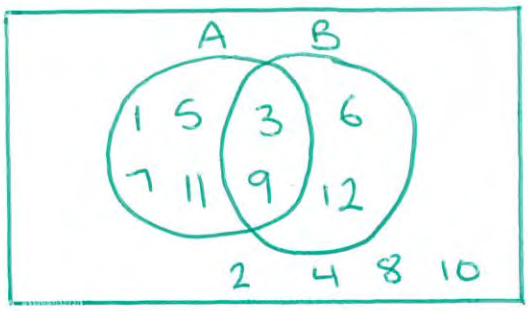
A card is selected at random from twelve cards which are numbered using the integers from 1 to 12. Numbers are not repeated. The elements of sets A and B are as follows:

$A = \{\text{cards with odd numbers}\}$

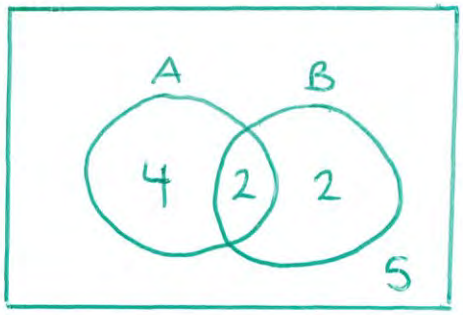
$B = \{\text{cards with numbers that are multiples of 3}\}$

a) Represent the two events A and B in a Venn diagram. **2**

$\frac{1}{2}$ for each section correct.



or



b) Find $P(A \cap B)$. **1**

$= \frac{2}{12}$

$= \frac{1}{6}$ (1)

c) Find $P(\bar{A})$. **1**

$= \frac{6}{12}$

$= \frac{1}{2}$ (1)

d) Find $P(A|B)$. **1**

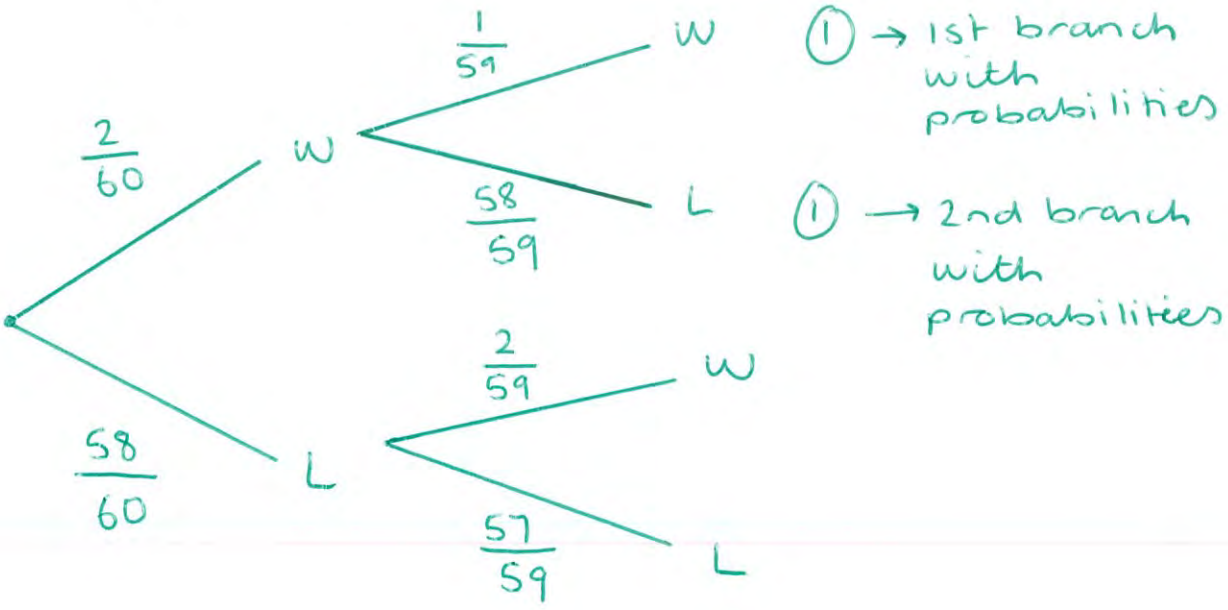
$= \frac{2}{4}$

$= \frac{1}{2}$ (1)

Question 25 (5 marks)

There are two prizes to be won in a raffle which has sold 60 tickets. The first prize is selected by drawing a ticket at random. This ticket IS NOT replaced for the draw for the second prize. Johnny has purchased two tickets for this raffle.

a) Draw a tree diagram to illustrate this situation. **2**



b) Find the probability that Johnny:

i. Wins both prizes. **1**

$P(WW) = \frac{2}{60} \times \frac{1}{59}$

$= \frac{1}{1770}$ (1)

ii. Wins at least one prize. **2**

$1 - P(LL) = 1 - \frac{58}{60} \times \frac{57}{59}$ (1)

$= \frac{39}{590}$ (1)

END OF SECTION

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Year 10 Assessment Task 4

Mathematics 5.3

Section IV Answer Booklet

25 marks
Attempt Questions 26 - 32
Allow about 30 minutes for this section.

Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your response should include relevant mathematical reasoning and/or calculations.
- Extra writing space is provided at the end of this examination. If you use this space, clearly indicate which question you are answering

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Please turn over

Question 26 (6 marks)

Consider the quadratic function $y = x^2 - 4x + 3$.

a) By completing the square, express $y = x^2 - 4x + 3$ in the form $y = (x - a)^2 - b$, where a and b are integers. **2**

$y = x^2 - 4x + (-2)^2 + 3 - (-2)^2$

$y = x^2 - 4x + 4 + 3 - 4$ (1)

$y = (x - 2)^2 - 1$ (1)

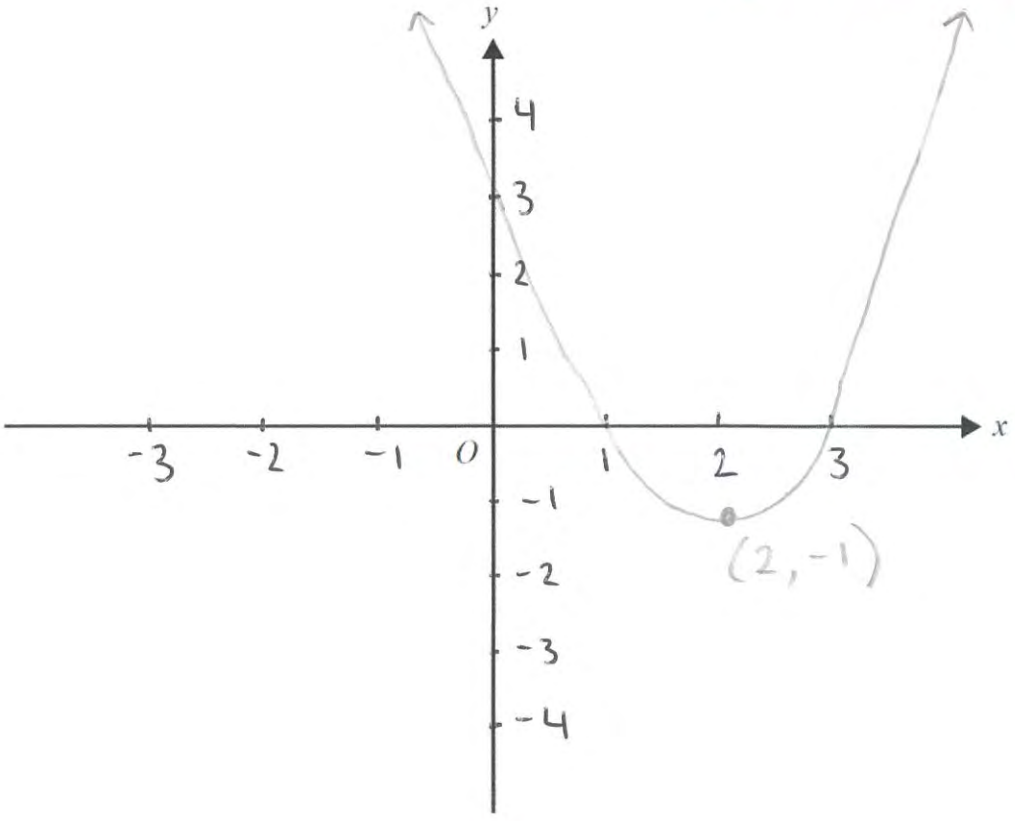
b) Hence, sketch $y = x^2 - 4x + 3$ showing the axis intercepts and the vertex. **4**

(1) - shape

(1) - y-intercept

(1) - x-intercepts

(1) - vertex



Question 27 (5 marks)

Points A and B have coordinates $(-2, 1)$ and $(6, 13)$ respectively, and point M is the midpoint of AB. Find the equation of the line perpendicular to AB which passes through the point M, giving your answer in general form. **5**

$MP_{AB} = \left(\frac{-2+6}{2}, \frac{1+13}{2}\right)$

$= (2, 7)$ (1)

$m_{AB} = \frac{13-1}{6+2}$

$= \frac{12}{8}$

$= \frac{3}{2}$ (1)

$\therefore m_{\perp} = -\frac{2}{3}$ (1)

$y - 7 = -\frac{2}{3}(x - 2)$ (1)

$3y - 21 = -2(x - 2)$

$3y - 21 = -2x + 4$

$2x + 3y - 25 = 0$ (1)

Question 28 (1 marks)

Solve $2^x = 3$. Give your answer correct to three decimal places. **1**

$x = \frac{\log_{10} 3}{\log_{10} 2}$

$= 1.585$ (1)

Question 29 (2 marks)

Find $f^{-1}(x)$ of $f(x) = \frac{2-x}{3}$. **2**

$y = \frac{2-x}{3}$

$\therefore x = \frac{2-y}{3}$ (1)

$3x = 2 - y$

$y = 2 - 3x$

$\therefore f^{-1}(x) = 2 - 3x$ (2)

Question 30 (2 marks)

Solve $3^{4x+2} = 27^{3x}$. **2**

$3^{4x+2} = (3^3)^{3x}$

$3^{4x+2} = 3^{9x}$ (1)

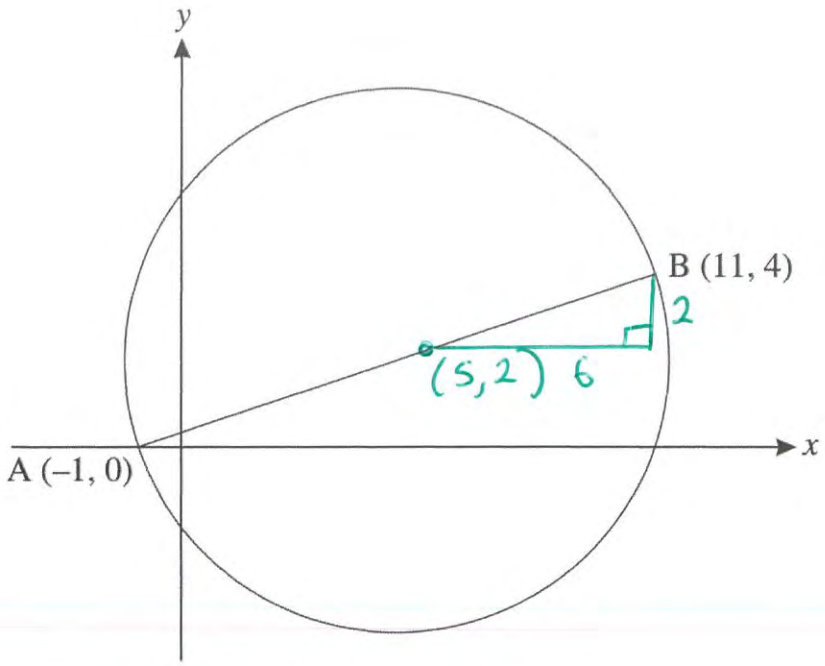
$\therefore 4x + 2 = 9x$

$2 = 5x$

$\therefore x = \frac{2}{5}$ (1)

Question 31 (3 marks)

The diagram below shows a graph with the diameter AB, which have coordinates $(-1, 0)$ and $(11, 4)$ respectively. **3**



Find the equation of the graph giving your answer in the form $(x-a)^2+(y-b)^2=r^2$ where a, b and r are integers.

$MP = \left(\frac{-1+11}{2}, \frac{0+4}{2}\right)$

$= (5, 2)$ (1) - midpoint

$d = \sqrt{2^2+6^2}$

$= \sqrt{40}$ (1) - progress

$\therefore (x-5)^2+(y-2)^2=40$

or $d = \sqrt{(11+1)^2+(4-0)^2}$

$= \sqrt{12^2+4^2}$

$= \sqrt{160}$

$= 4\sqrt{10}$

$\therefore r = \frac{4\sqrt{10}}{2}$

$= 2\sqrt{10}$

$\therefore (x-5)^2+(y-2)^2=40$

(1) - radius

Question 32 (3 marks)

Solve $2\log_a x - \log_a(3x - 5) = \log_a 4$. **3**

$\log_a x^2 - \log_a(3x-5) = \log_a 4$ (½)

$\log_a\left(\frac{x^2}{3x-5}\right) = \log_a 4$

$\frac{x^2}{3x-5} = 4$ (½)

$x^2 = 4(3x-5)$

$x^2 = 12x - 20$ (½)

$x^2 - 12x + 20 = 0$ (½)

$(x-10)(x-2) = 0$ (½)

$x = 10 \quad x = 2$ (½)

End of Paper