The Scots College

Name: _____

Teacher: _____

2023

Year 10 Assessment Task 4

Monday 30th 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 2 - 4

Multiple Choice Section 1	
Section 2	
Section 3 *Trigonometry*	
Section 3 *Probability*	
Section 4	
Total	

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

Section 2 – 22 marks (pages 7–11)
- Attempt Questions 9–17
- Allow about 25 minutes for this section

Section 3 – 28 marks (pages 12-18)
- Attempt Questions 18–25
- Allow about 30 minutes for this section

Section 4 – 22 marks (pages 19-22)
- Attempt Questions 26–30
- Allow about 25 minutes for this section

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Section 1

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

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

---

1 What is $(3x + 2y) – (x – y)$ when fully simplified?

A. $2x + 3y$

B. $2x + y$

C. $4x + 3y$

D. $3 + 2x$

2 What is the y - intercept of the line with equation $2023x - 4y + 8 = 0$?

A. -2

B. 2

C. 8

D. 2023

3 How many solutions does the quadratic equation $2x^2 + 10x = 3$ have?

A. zero solutions

B. one solution

C. two solutions

D. three solutions

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

A. $x > -4$

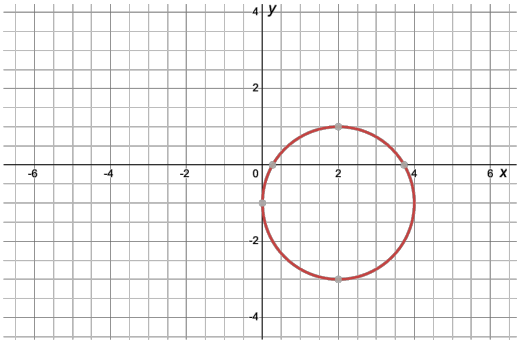
B. $x > 4$

C. $x < -4$

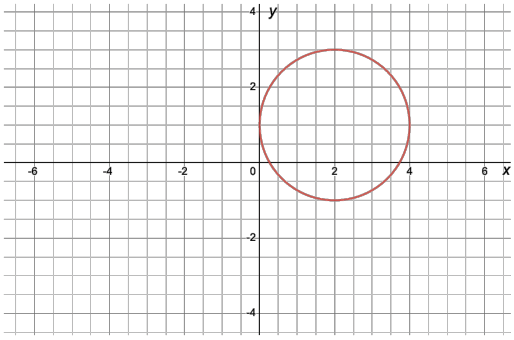
D. $x < 4$

5 Which of the graphs best represents the relation $(x - 2)^2 + (y + 1)^2 = 4$?

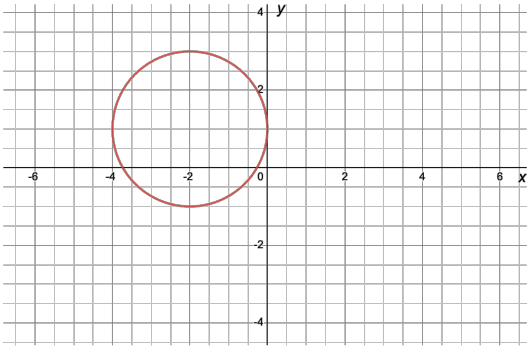
A



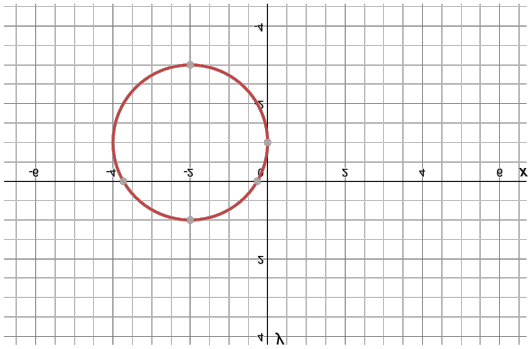
B



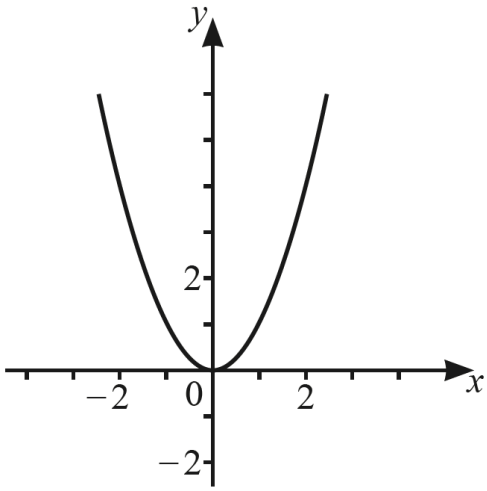
C



D

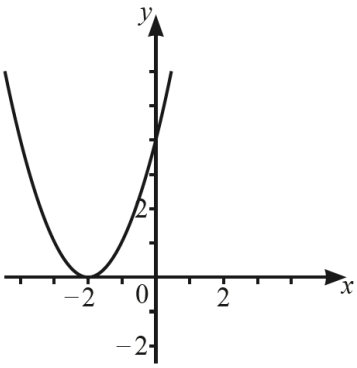


6 The diagram shows the graph of $y = f(x)$.

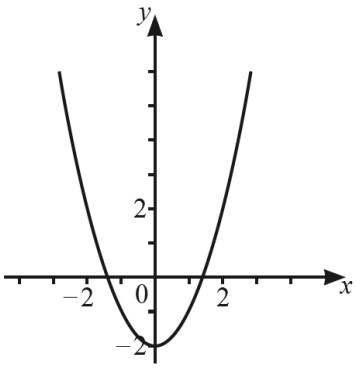


Which of the diagrams below represents $y = f(x) - 2$?

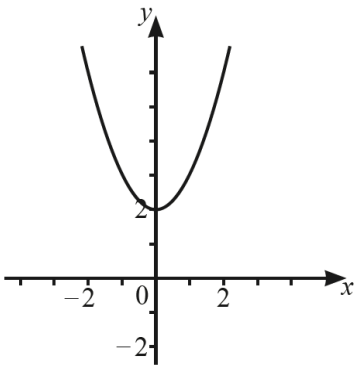
A.



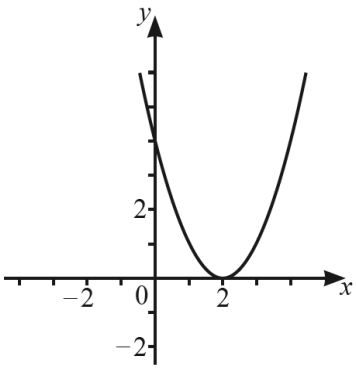
B.



C.



D.



7 What is the inverse function of $f(x) = \frac{1}{x-2} + 3$?

A. $f^1(x) = \frac{1}{x+3} - 2$

B. $f^1(x) = \frac{1}{x+2} + 3$

C. $f^1(x) = \frac{1}{x-3} + 2$

D. $f^1(x) = \frac{1}{x+2} - 3$

8 What is the domain of $y = \frac{1}{\sqrt{-x}}$?

A. $x \geq 0$

B. $x > 0$

C. $x \leq 0$

D. $x < 0$

END OF SECTION 1

SECTION 2

Question 9 (3 marks)

Make y the subject in each part below:

a) $x = \frac{1}{y}$ **1**

b) $T = \frac{3(y+k)}{4c}$ **2**

Question 10 (2 marks)

Rationalise the denominator of $\frac{2}{\sqrt{2}-2}$ giving your answer in simplified form. **2**

Question 11 (2 marks)

Solve $(2x - 1)(x + 5) = 0$. **2**

Question 12 (3 marks)

Solve $x^2 - 10x + 7 = 0$ by using the quadratic formula. **3**

Question 13 (3 marks)

Simplify $\frac{2}{x-1} + \frac{4}{x^2+2x-3}$ **3**

Question 14 (2 marks)

Simplify fully $\frac{6x}{x-1} \div \frac{3x^2}{x+2}$. **2**

Question 15 (2 marks)

Factorise $3x^2 - 4x - 15$ **2**

Question 16 (2 marks)

Solve for x.

a) $\log_x 125 = 3$ **1**

---

b) $x = \log_4 17$ **1**

Question 17 (3 marks)

Find the points of intersection of the curve $y = x^2 - 2x - 1$ and the line $4x + 2y = 0$ **3**

END OF SECTION 2

SECTION 3

Question 18 (2 marks)

Three towns, *A, B* and *C*, are connected by straight roads. The distance from town *A* to town *B* is 25 *km* and the distance from town *A* to town *C* is 18 *km*. If the angle between the two roads *AB* and *AC* is 65°, what is the distance *BC* to the nearest kilometre? **2**

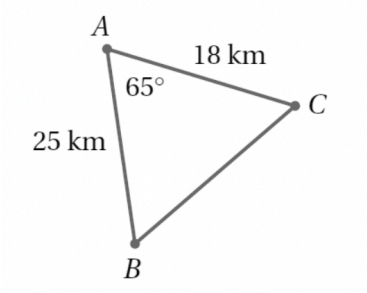
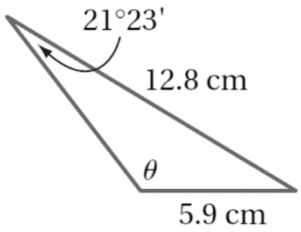


Diagram Not to Scale

Question 19 (2 marks)

Given that θ is obtuse, find the value of θ correct to the nearest minute. **2**



Not to scale

Question 20 (4 marks)

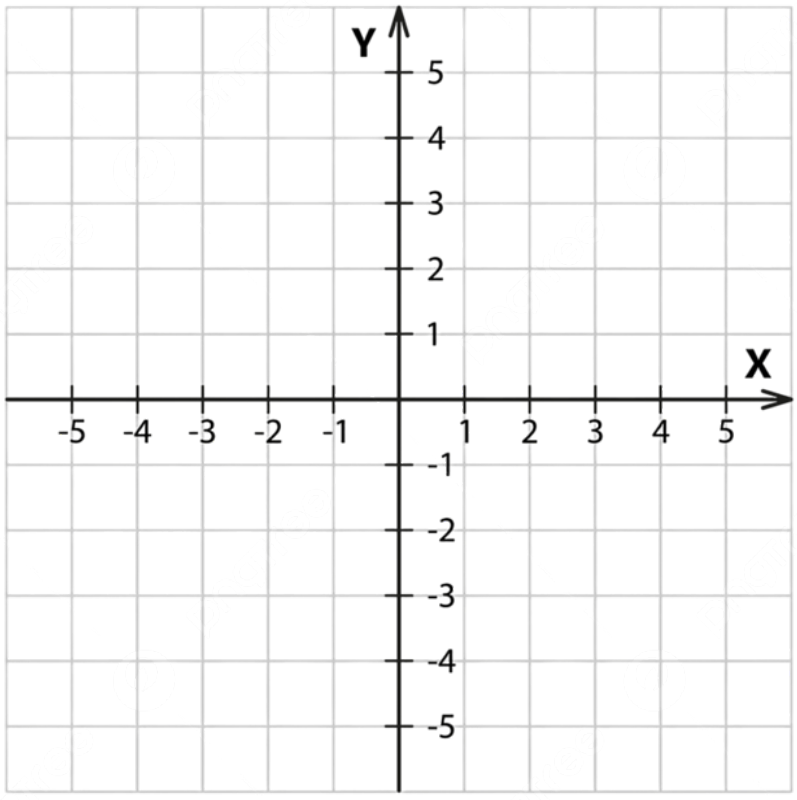
(a) Fill in the table of values below for the given log equation. **2**

$$y = \log_4(x + 2)$$

x		0	2
y	0	0.5	

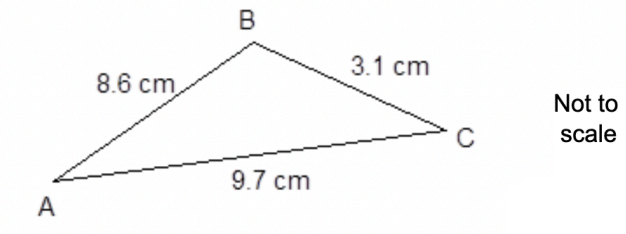
(b) Sketch the graph for this log equation, labelling any intercepts. Also sketch and write the equation of the asymptote. **2**

$$y = \log_4(x + 2)$$



Question 21 (4 marks)

In ΔABC, $AB = 8.6\ cm$, $BC = 3.1\ cm$, and $AC = 9.7$cm.

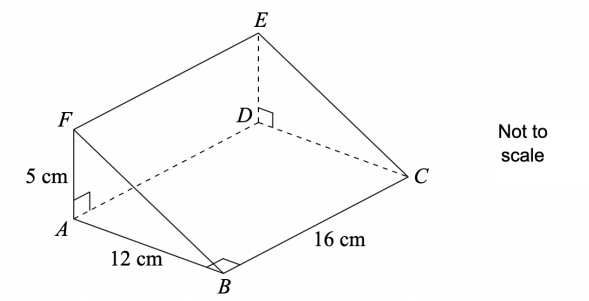


(c) Find the size of $\angle ABC$ to the nearest minute. **2**

(d) Find the Area of ΔABC, leaving your answer correct to one decimal place. **2**

Question 22 (3 marks)

A right triangular prism is shown in the diagram below, with $AB = 12$ cm, $BC = 16$ cm, and $AF = 5$ cm.

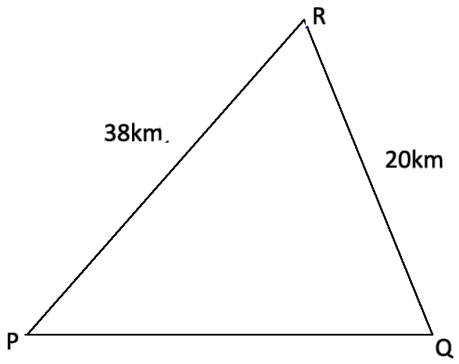


(a) Find the volume of the prism **1**

(b) Determine the size of the angle between the diagonals AC and CF. **2**

Question 23 (3 marks)

In the diagram below, the point Q is due east of P. The point R is 38 km from P and 20 km from Q. The bearing of R from Q is 325°.



(a) What is the size of $\angle PQR$? **1**

(b) What is the bearing of R from P? **2**

Question 24 (5 marks)

In many countries, the police stop drivers on suspicion of drunk driving. The stopped drivers are given a breath test, or a blood test, or both. In one country, the police records show the following:

81% of the drivers stopped are given a breath test, 40% a blood test, and 25% both tests.

(a) Represent the information above using a Venn diagram **2**

(b) What is the probability that a suspected driver is given a test? **1**

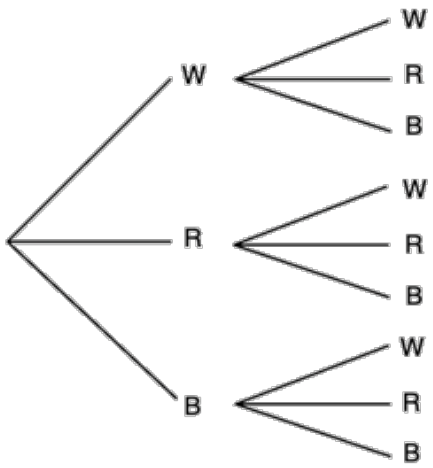
(c) What is the probability that a suspected driver is given exactly one test? **1**

(d) What is the probability that a suspected driver is given no test? **1**

Question 25 (5 marks)

In a probability experiment five white discs, four red discs and three blue discs are placed in a hat. Two discs are selected at random without replacement.

(a) Complete the probability tree diagram and include a list of a possible outcomes. **2**



(b) Find the probability that both discs selected are red **1**

(c) Find the probability that a red and white disc are selected **2**

END OF SECTION 3

SECTION 4

Question 26 (8 marks)

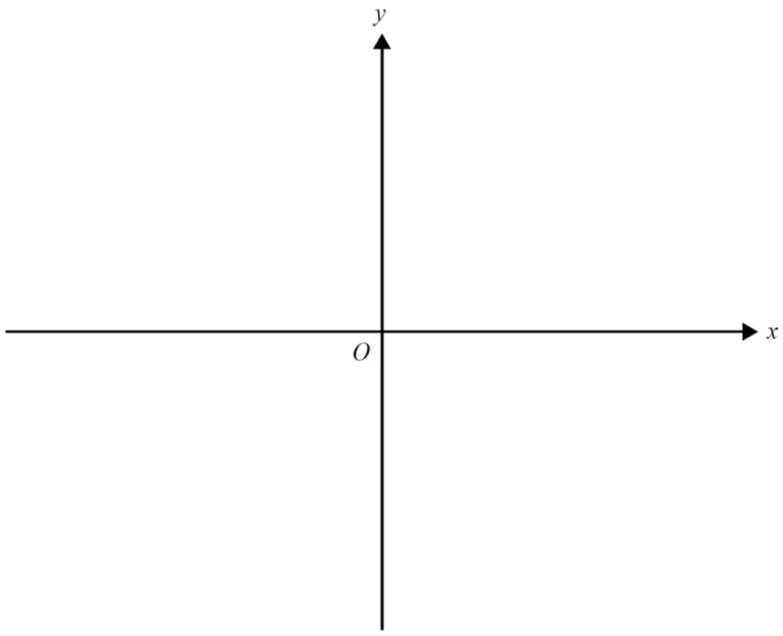
Consider the quadratic function $y = x^2 - 8x + 10$.

(a) By completing the square, express $y = x^2 - 8x + 10$ in the form $y = (x - h)^2 - k$, where h and k are integers. **2**

(b) State the coordinates of the vertex of $y = x^2 - 8x + 10$ **1**

(c) State the x-intercepts of $y = x^2 - 8x + 10$ in exact form. **2**

(d) Hence, sketch $y = x^2 - 8x + 10$ showing the axis intercepts and the vertex. **3**



Question 27 (6 marks)

The diagram shows ΔABC with vertices $A(-2,\ 2)$, $B(-1.\ -5)$ and $C(6,\ -6)$.

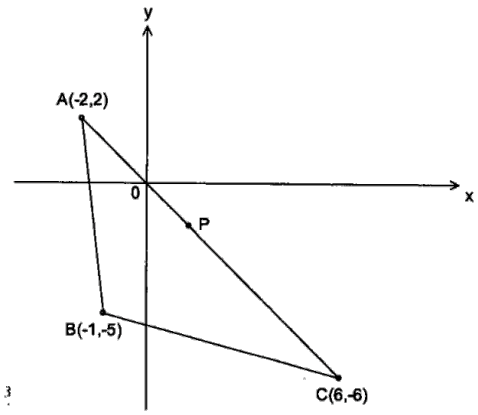


Diagram no to scale

(a) P is the midpoint of AC. Show that the coordinates of P are $(2,\ -2)$. **2**

(b) Show that the equation of BP is $y = x - 4$. **2**

(c) Find the coordinates of D, if P is the midpoint of BD. **2**

Question 28 (3 marks)

Consider the function $f(x) = 5 - \sqrt{4 - x^2}$.

(a) Does the value $x = 5$ lie on the curve $y = 5 - \sqrt{4 - x^2}$? Explain your answer. **1**

(b) Determine the equation of $f^{-1}(x)$. **2**

Question 29 (2 marks)

Solve $8^{3x-1} = 16$. **2**

Question 30 (3 marks)

Solve $2\log_{10}(x-3) = \log_{10}(x+17)$ **3**

End of Paper

Additional writing space

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

Additional writing space

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

The Scots College

Name: Solutions

Teacher: _____

2023

Year 10 Assessment Task 4

Monday 30th October

Mathematics 5.3

Weighting: 40%
Total marks: 80

General Instructions

- Reading time – 5 minutes
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Section 3 *Probability*	
Section 4	
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Section 1

8 marks
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Allow about 10 minutes for this section.

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1 What is $(3x + 2y) - (x - y)$ when fully simplified?

A. $2x + 3y$

B. $2x + y$

C. $4x + 3y$

D. $3 + 2x$

2 What is the y - intercept of the line with equation $2023x - 4y + 8 = 0$?

A. -2

B. 2

C. 8

D. 2023

3 How many solutions does the quadratic equation $2x^2 + 10x = 3$ have?

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B. one solution

C. two solutions

D. three solutions

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

A. $x > -4$

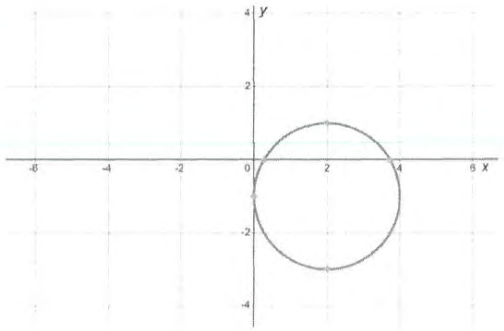
B. $x > 4$

C. $x < -4$

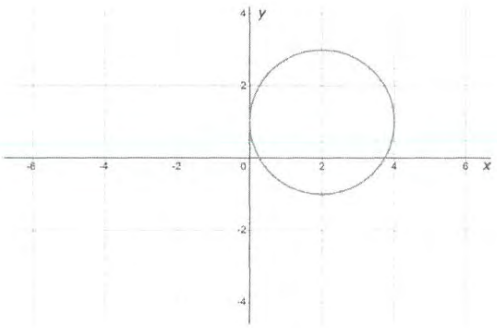
D. $x < 4$

5 Which of the graphs best represents the relation $(x - 2)^2 + (y + 1)^2 = 4$?

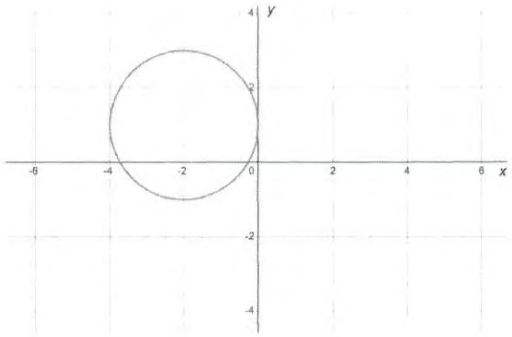
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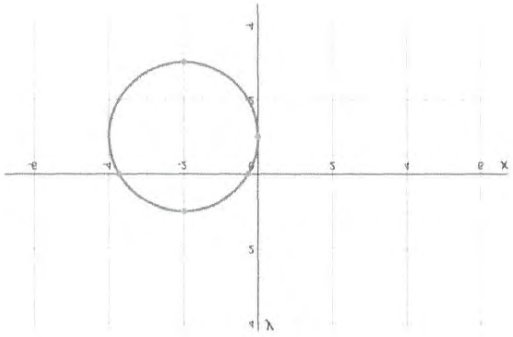
B



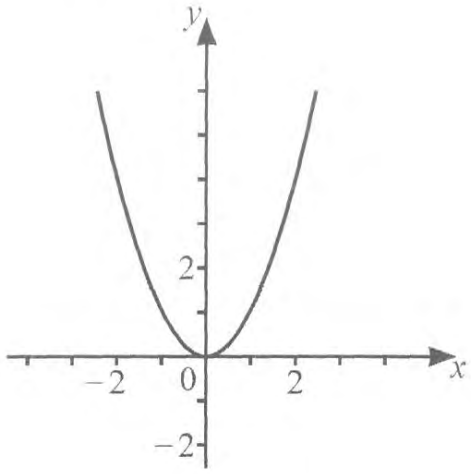
C



D

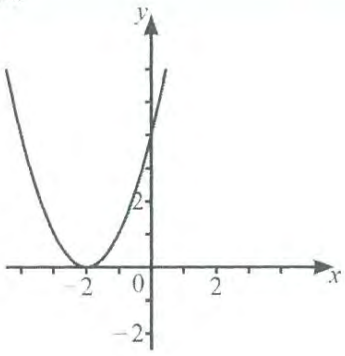


6 The diagram shows the graph of $y = f(x)$.

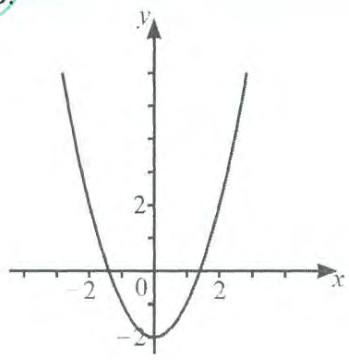


Which of the diagrams below represents $y = f(x) - 2$?

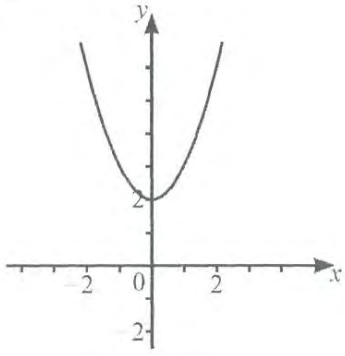
A.



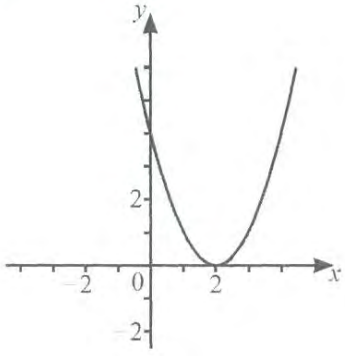
B.



C.



D.



7 What is the inverse function of $f(x) = \frac{1}{x-2} + 3$?

A. $f^{-1}(x) = \frac{1}{x+3} - 2$

B. $f^{-1}(x) = \frac{1}{x+2} + 3$

C. $f^{-1}(x) = \frac{1}{x-3} + 2$

D. $f^{-1}(x) = \frac{1}{x+2} - 3$

8 What is the domain of $y = \frac{1}{\sqrt{-x}}$?

A. $x \geq 0$

B. $x > 0$

C. $x \leq 0$

D. $x < 0$

END OF SECTION

Question 9 (3 marks)

Make y the subject in each part below;

a) $x = \frac{1}{y}$ **1**

$xy = 1$

$y = \frac{1}{x}$ A1

b) $T = \frac{3(y+k)}{4c}$ **2**

$4cT = 3(y+k)$ M1

$\frac{4cT}{3} = y + k$

$y = \frac{4cT}{3} - k$ OR $y = \frac{4}{3}cT - k$ A1

Question 10 (2 marks)

Rationalise the denominator of $\frac{2}{\sqrt{2}-2}$ giving your answer in simplified form. **2**

$\frac{2}{\sqrt{2}-2} \times \frac{\sqrt{2}+2}{\sqrt{2}+2}$ M1 multiply by $\frac{\sqrt{2}+2}{\sqrt{2}+2}$

$= \frac{2(\sqrt{2}+2)}{(\sqrt{2}-2)(\sqrt{2}+2)}$

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

$= -(\sqrt{2}+2)$

$= -\sqrt{2}-2$ A1

Question 11 (2 marks)

Solve $(2x - 1)(x + 5) = 0$. **2**

$2x - 1 = 0$ $\quad x + 5 = 0$

$2x = 1$ $\quad x = -5$

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

$x = \frac{1}{2}$ or -5

(A1) (A1)

Question 12 (3 marks)

Solve $x^2 - 10x + 7 = 0$ by using the quadratic formula. **3**

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{10 \pm \sqrt{100 - 4 \times 7}}{2}$ ← (M1) attempt to insert a, b & c into the quadratic formula.

$= \frac{10 \pm \sqrt{72}}{2}$

$= \frac{10 \pm 6\sqrt{2}}{2}$ ← (B1) for at least 2 correct terms

$= 5 \pm 3\sqrt{2}$ (A1) including $\pm$ sign.

Question 13 (3 marks)

Simplify $\frac{2}{x-1}+\frac{4}{x^2+2x-3}$ 3

$= \frac{2}{x-1} + \frac{4}{(x+3)(x-1)}$ (M1) correct factorising

$= \frac{2(x+3)}{(x+3)(x-1)} + \frac{4}{(x+3)(x-1)}$ (M1) show common denominator

$= \frac{2x+6+4}{(x+3)(x-1)}$

$= \frac{2x+10}{(x+3)(x-1)} = \frac{2x+10}{x^2+2x-3}$ ✓

(A1) accepted

Question 14 (2 marks)

Simplify fully $\frac{6x}{x-1} \div \frac{3x^2}{x+2}$. 2

(½) reciprocal is seen if simplified incorrectly

$= \frac{6x}{x-1} \times \frac{x+2}{3x^2}$

$= \frac{2}{x-1} \times \frac{x+2}{x}$ (M1) correct simplification

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

$= \frac{2x+4}{x^2-x}$ (A1)

Question 15 (2 marks)

Factorise $3x^2 - 4x - 15$ **2**

M_1 seen OR attempt to solve $ab = 3 \times -15 = -45$, $a + b = -4$

$3x^2 - 9x + 5x - 15$ $\quad a = -9$, $b = 5$

$= 3x(x-3) + 5(x-3)$

$= (3x+5)(x-3)$ A_1

Question 16 (2 marks)

Solve for x.

a) $\log_x 125 = 3$ **1**

$x^3 = 125$ $\frac{1}{2}$

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

b) $x = \log_4 17$ **1**

$x = 2.04$ (2dp)

A_1

Question 17 (3 marks)

Find the points of intersection of the curve $y = x^2 - 2x - 1$ and the line $4x + 2y = 0$ **3**

$4x + 2y = 0$ (B½) attempt to make y the subject

$2y = -4x$

$y = -2x$ (M1)

$-2x = x^2 - 2x - 1$ (B½) if seen

$x^2 - 1 = 0$

$(x+1)(x-1) = 0$

$x = 1$ or -1 (M1) solving equation correctly and show both solutions.

$y = -2$ or 2

(B½) attempt to find y by using x.

$(1, -2)$ or $(-1, 2)$

(A1) both points are shown correctly

END OF SECTION

Question 18 (2 marks)

Three towns, *A, B* and *C*, are connected by straight roads. The distance from town *A* to town *B* is 25 *km* and the distance from town *A* to town *C* is 18 *km*. If the angle between the two roads *AB* and *AC* is 65^0, what is the distance *BC* to the nearest kilometre? **2**

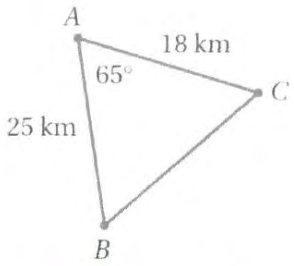


Diagram Not to Scale

$BC^2 = AB^2 + AC^2 - 2AB \times AC \times \cos A$

$BC^2 = 25^2 + 18^2 - 2 \times 25 \times 18 \times \cos 65^\circ$

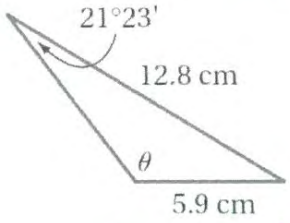
$BC^2 = 568.64$ (M1) correct use of cosine rule

$BC = 23.85$ km

(A1) (½) if BC^2 is seen ONLY

Question 19 (2 marks)

Given that θ is obtuse, find the value of θ correct to the nearest minute. **2**



Not to scale

$\frac{\sin\theta}{12.8} = \frac{\sin 21^\circ 23'}{5.9}$ (1) correct use of sine rule

$\sin\theta = 0.79$

$\theta = \sin^{-1}(0.79)$ (½) if 52.28° is seen

$\theta = 52.28^\circ$

$\therefore \theta$ is obtuse

$\therefore \theta$ is $180^\circ - 52.28^\circ = 127.72^\circ = 127^\circ 43'$ (A1)

Question 20 (5 marks)

(a) Fill in the table of values below for the given log equation. **2**

$$y = \log_4(x + 2)$$

x	−1	0	2
y	0	0.5	1

$0 = \log_4 x+2$

$4^0 = x+2$

$1 = x+2$

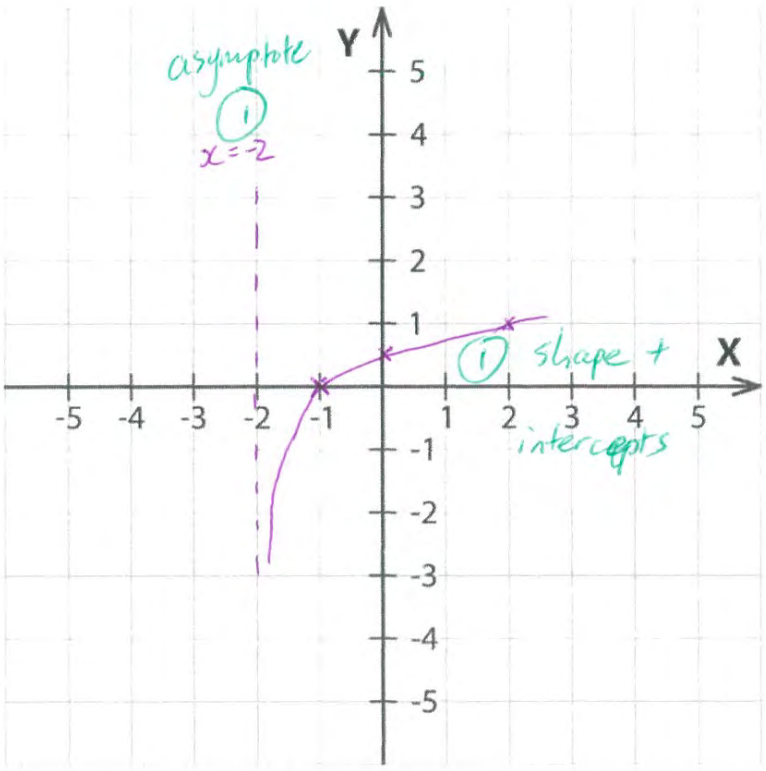
$x = -1$ (1)

$y = \log_4(2+2)$

$y = 1$ (1)

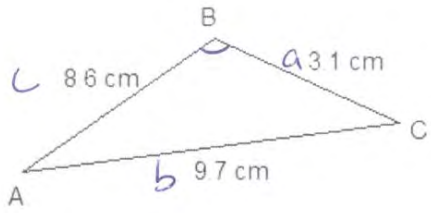
(b) Sketch the graph for this log equation, labelling any intercepts. Also sketch and write the equation of the asymptote. **2**

$$y = \log_4(x + 2)$$



Question 21 (4 marks)

In ΔABC, $AB = 8.6\ cm$, $BC = 3.1\ cm$, and $AC = 9.7$cm.



Not to scale

(a) Find the size of $\angle ABC$ to the nearest minute. **2**

$\cos B = \frac{a^2+c^2-b^2}{2ac} = -0.197$ (M1) correct use of cosine rule

$B = 101.38^\circ \approx 101^\circ 23'$ (A1)

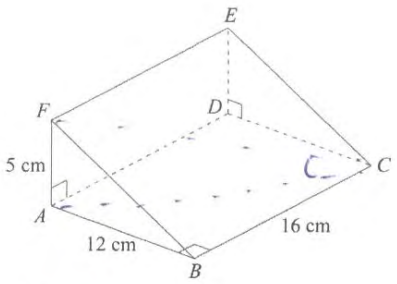
(b) Find the Area of ΔABC, leaving your answer correct to one decimal place. **2**

Area $= \frac{1}{2} \times a \times c \times \sin B$ (M1)

$= 13.1\ cm^2$ (A1)

Question 22 (3 marks)

A right triangular prism is shown in the diagram below, with $AB = 12$ cm, $BC = 16$ cm, and $AF = 5$ cm.



Not to scale

(a) Find the volume of the prism **1**

$V = \frac{12 \times 5}{2} \times 16$ OR $M\frac{1}{2}$ if seen

$= 30 \times 16$

$= 480\ cm^3$ A_1

(b) Determine the size of the angle between the diagonal's AC and CF. **2**

$AC = \sqrt{12^2 + 16^2} = 20$

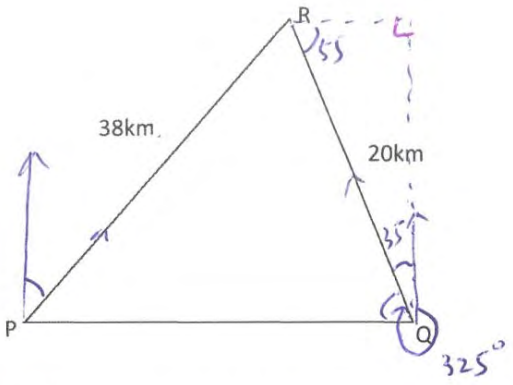
$FC = \sqrt{5^2 + 20^2} = 20.62$ M_1 if one is seen

$\cos CFCA = \frac{CF^2 + AC^2 - FA^2}{2 \times CF \times AC} = 0.97$ $M\frac{1}{2}$ if seen.

$CFCA = 14.09°$ A_1

Question 23 (3 marks)

In the diagram below, the point Q is due east of P. The point R is 38 km from P and 20 km from Q. The bearing of R from Q is 325°. **3**



(a) What is the size of $\angle PQR$?

$\angle PQR = 325^\circ - 180^\circ - 90^\circ$

$= 55^\circ$ (1)

(b) What is the bearing of R from P?

$\frac{\sin \angle RQP}{38} = \frac{\sin \angle RPQ}{20}$

$\angle RPQ = 25.54^\circ$ (M1)

bearing of R from P $= 90 - 25.54$

$= 64.46$

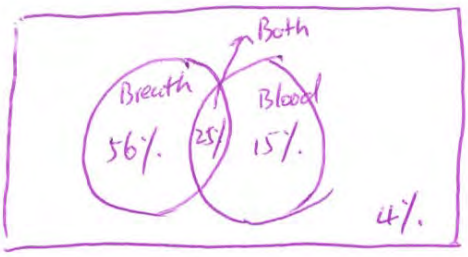
$= 064^\circ$ (A1) accept 64°

Question 24 (5 marks)

In many countries, the police stop drivers on suspicion of drunk driving. The stopped drivers are given a breath test, or a blood test, or both. In one country, the police records show the following:

81% of the drivers stopped are given a breath test, 40% a blood test, and 25% both tests.

(a) Represent the information above using a Venn diagram **2**



(1) correct percentage

(2) correct labelling

(b) What is the probability that a suspected driver is given a test? **1**

P(test) = 96%. (1)

(c) What is the probability that a suspected driver is given exactly one test? **1**

P(one test) = 56 + 15 = 71%. (1)

(d) What is the probability that a suspected driver is given no test? **1**

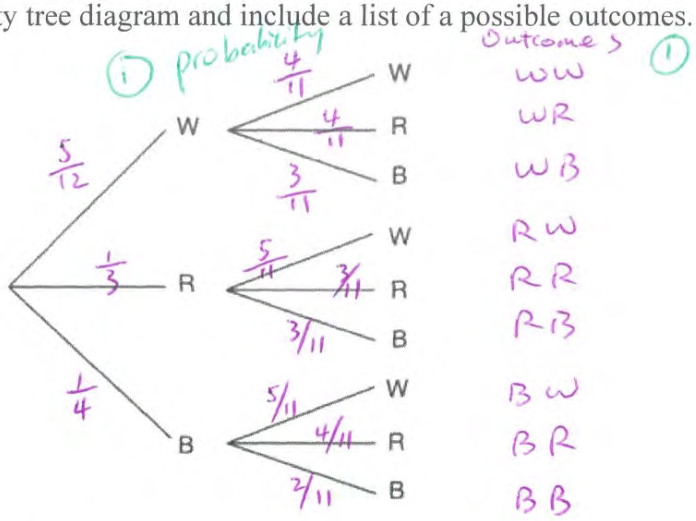
P(no test) = 100 − (81 + 40 − 25)

= 4%. (1)

Question 25 (4 marks)

In a probability experiment five white discs, four red discs and three blue discs are placed in a hat. Two discs are selected at random without replacement.

(a) Complete the probability tree diagram and include a list of a possible outcomes. **2**



(b) Find the probability that both discs selected are red **1**

$P(\text{both } R) = \frac{1}{3} \times \frac{3}{11} = \frac{1}{11}$ (1)

(c) Find the probability that a red and white disc are selected **2**

$P(R+W) = \frac{1}{3} \times \frac{5}{11} + \frac{5}{12} \times \frac{4}{11}$ ($\frac{1}{2}$, $\frac{1}{2}$)

$= \frac{5}{33} + \frac{5}{33}$

$= \frac{10}{33}$ (1)

END OF SECTION

Question 26 (8 marks)

Consider the quadratic function $y = x^2 - 8x + 10$.

(a) By completing the square, express $y = x^2 - 8x + 10$ in the form $y = (x - h)^2 - k$, where h and k are integers. **2**

$y = (x-4)^2 + 10 - 16$ (1)

$y = (x-4)^2 - 6$

$h = 4$, $k = 6$ (A1)

(b) State the coordinates of the vertex of $y = x^2 - 8x + 10$ **1**

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

$x = -\frac{b}{2a} = -\frac{-8}{2} = 4$ $\quad y = 16 - 32 + 10 = -6$ $\quad (4, -6)$ (A1)

(c) State the x-intercepts of $y = x^2 - 8x + 10$ in exact form. **2**

$x^2 - 8x + 10$

$= (x-4)^2 - 6 = 0$ (M1)

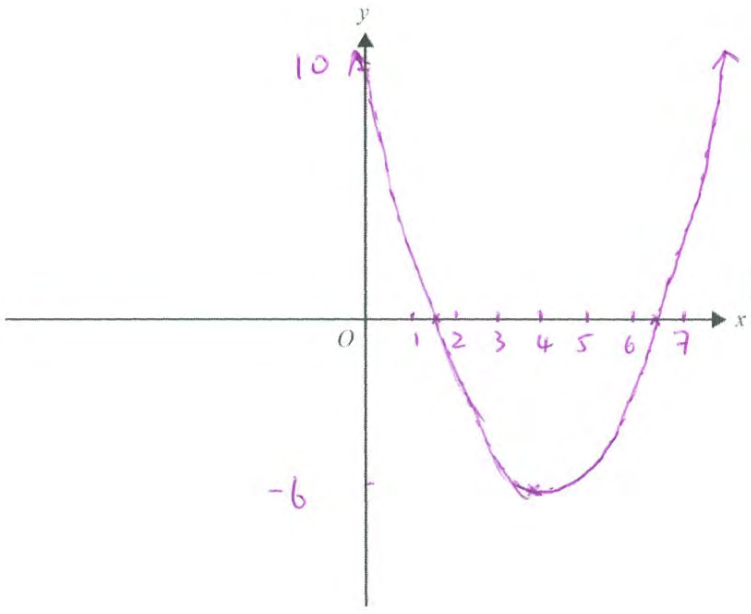
$(x-4)^2 = 6$

$x - 4 = \pm\sqrt{6}$

$x = \pm\sqrt{6} + 4$ (A1)

Using quadratic formula is accepted if correct answers are seen.

(d) Hence, sketch $y = x^2 - 8x + 10$ showing the axis intercepts and the vertex. **3**



(1) correct shape

(1) correct x-intercepts

(1) correct y-intercept + vertex

Question 27 (6 marks)

The diagram shows ΔABC with vertices $A(-2,\ 2)$, $B(-1.\ -5)$ and $C(6,\ -6)$.

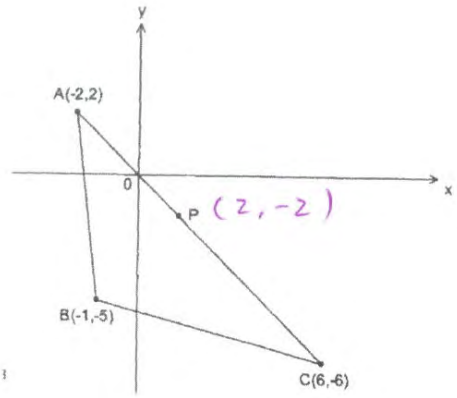


Diagram no to scale

(a) P is the midpoint of AC. Show that the coordinates of P are $(2, -2)$. **2**

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

(b) Show that the equation of BP is $y = x - 4$. **2**

$y = mx + b$ $\quad m = \frac{-2-(-5)}{2-(-1)} = \frac{3}{3} = 1$ (M_1)

$\therefore y = x + b$

Sub $(2, -2)$ into $y = x + b$

$-2 = 2 + b$ $\quad b = -4$ (M_1) $\quad y = x - 4$

alternative method is accepted

$-2 = 2m + b$

$-5 = m + b$

(c) Find the coordinates of D, if P is the midpoint of BD. **2**

$D(x, y)$ $\quad \frac{x+(-1)}{2} = 2$

$x = 5$ (1)

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

$D: (5, 1)$

Question 28 (3 marks)

Consider the function $f(x) = 5 - \sqrt{4 - x^2}$.

(a) Does the value $x = 5$ lie on the curve $y = 5 - \sqrt{4 - x^2}$? Explain your answer. **1**

No $\because \sqrt{4-x^2} \geq 0$

if $x = 5$, $\sqrt{4-5^2} < 0$, does not satisfy $\sqrt{4-x^2} \geq 0$ (1)

(b) Determine the equation of $f^{-1}(x)$. **2**

$x = 5 - \sqrt{4-y^2}$ (B$\frac{1}{2}$) if seen.

$\sqrt{4-y^2} = 5 - x$

$4 - y^2 = 25 + x^2 - 10x$ $\quad \because \sqrt{4-y^2} \geq 0$

$-y^2 = x^2 - 10x + 21$ $\quad \therefore -2 \leq y \leq 2$

$y^2 = -x^2 + 10x - 21$ $\quad \therefore 3 \leq x \leq 5$

$y = \pm\sqrt{-x^2+10x-21}$ (A1) if seen

$x \in [3, 5]$ (A1) if seen.

domain needs to be shown for full mark(s)

Question 29 (2 marks)

Solve $8^{3x-1} = 16$. **2**

$2^{3(3x-1)} = 2^4$ (M½ if seen)

(M½) $\rightarrow 3(3x-1) = 4$

$9x - 3 = 4$

$9x = 7$

$x = 7/9$ (A1)

alternative method

$\log_8 16 = 3x - 1$ (1)

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

$4 = 9x - 3$

$7 = 9x$

$x = 7/9$ (1)

Question 30 (3 marks)

Solve $2\log_{10}(x-3) = \log_{10}(x+17)$ **3**

$\log_{10}(x-3)^2 = \log_{10} x+17$

$(x-3)^2 = x+17$ ← (M1 if seen)

$x^2 + 9 - 6x - x - 17 = 0$

$x^2 - 7x - 8 = 0$ (M1 correct simplification)

$(x-8)(x+1) = 0$

$x = 8$ & -1 (A1 both answers)