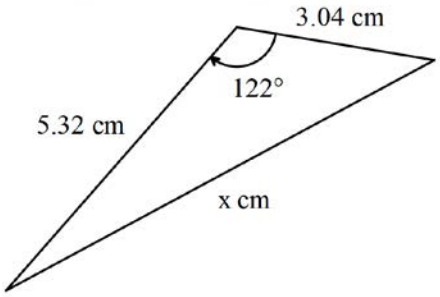
Section A – Trigonometry (15 Marks) Start a **NEW** page

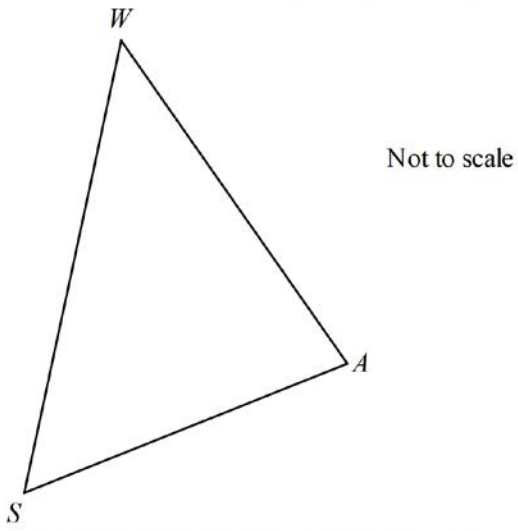
1. Find the value of x to 2 decimal places.



2

2. ΔABC has an area of $30\,cm^2$. AB = 8 cm and AC = 11 cm. Find the size(s) of $\angle BAC$ to the nearest degree. **3**

3. Alloy (A) sees a Watcher (W) 18 metres away at a bearing of $339°$. She turns and sees a Strider (S) 13 metres away at a bearing of $249°$.



Not to scale

(i) Find $\angle SAW$. **1**

(ii) Find the distance between the Watcher and the Strider to 2 decimal places. **2**

(iii) Find the bearing of the Watcher from the Strider. **3**

4.

(i) Draw a neat sketch of $y = 2\cos(\frac{x}{2})$ for $0 \leq x \leq 360°$. **3**

(ii) Hence or otherwise, find the <u>number</u> of solutions to the equation:

$2\cos(\frac{x}{2}) = \sqrt{3}$ for $0 \leq x \leq 360°$. **1**

Section B – Number & Algebra (17 Marks) Start a **NEW** page

1. Write the following in scientific notation to 3 significant figures:

$$\left(\frac{2\pi}{10000}\right)^{\frac{3}{2}}$$ **2**

2.

(i) Rationalise the denominator of:

$$\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$$ **2**

(ii) Hence or otherwise, find the values of *a*, *b* and *c*.

$$\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}} = a\sqrt{b}+c$$ **1**

3. Fully factorise:

(i) $3x^2 - 12$ **2**

(ii) $x^3 + 64$ **2**

(iii) $6x^2 - 25x + 14$ **2**

4. Two similar figurines have the following volumes:

Figurine A = 125 cm^3

Figurine B = 2744 cm^3

If the surface area of Figurine A is 75 cm^2.

Calculate the surface area of Figurine B. **3**

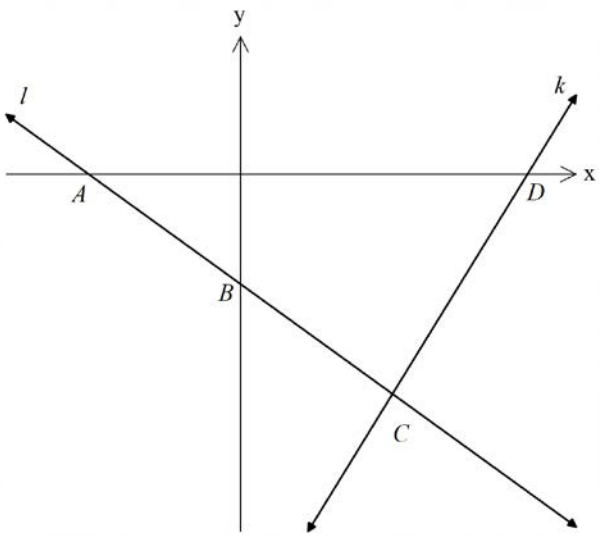
5. Fully simplify:

$$\frac{\frac{a+b}{b}+\frac{a+b}{a}}{\frac{a}{b}-\frac{b}{a}}$$ **3**

Section C – Coordinate Geometry & Locus (8 Marks) Start a **NEW** page

1. Find the equation of the locus of the point $P(x, y)$ that moves such that it is equidistant from $A(-2, -3)$ and $B(2, 5)$. **3**

2. In the diagram below the line ℓ has the equation $2x + 3y + 6 = 0$. It cuts the *x* axis at *A*, the *y* axis at *B* and it intersects the line *k* at *C*. Line *k* is perpendicular to line ℓ and cuts the *x* axis at *D*.



(i) Find the coordinates of *A* and *B*. **2**

(ii) If B is the midpoint of AC, find the coordinates of C. **1**

(iii) Hence or otherwise find the equation of *k*. **2**

Section D – Probability and Finance (7 Marks) Start a **NEW** page

1. Two cards are drawn without replacement from a standard 52 card deck. Calculate the probability that:

(i) They are both are diamonds. **1**

(ii) They are both the same suit. **1**

(iii) One is a picture card and the other is the Ace of Spades. **1**

2. Chuck-a-luck is a European dice game, the rules are as follows:

A player nominates a number from $1 - 6$ and three dice are thrown:

If their number appears on one die they win one prize.

If their number appears on two dice they win two prizes.

If their number appears on all three dice they win three prizes.

What is the probability that someone playing Chuck-a-luck wins at least 1 prize? **1**

3. The table below shows the monthly payments required to repay a loan of $1000 over periods of 1 to 5 years at monthly reducible interest rates.

Interest rate p.a.	1 year	2 years	3 years	4 years	5 years
9%	87.50	45.68	31.80	24.81	20.76
9.5%	87.68	45.91	32.03	25.12	21.00
10%	87.92	46.14	32.27	25.36	21.25
10.5%	88.15	46.38	32.50	25.60	21.49
11%	88.38	46.61	32.74	25.85	21.74
11.5%	88.62	46.84	32.98	26.09	21.99
12%	88.85	47.07	33.21	26.33	22.24

(i) What is the total amount that would have to be repaid if $15 000 is to be borrowed for 3 years at 11% p.a reducible interest? **1**

(ii) What is the equivalent rate of simple interest? **2**

Section E – Functions and Quadratics (15 Marks) Start a **NEW** page

1.

(i) For $f(x) = \frac{1}{x}$, sketch

$y = f(x-1)$

showing all relevant features **2**

(ii) For $g(x) = 2^x$, sketch

$y = g(-x) + 1$

showing all relevant features **3**

2. Draw a neat sketch of $x^2 - 4x + y^2 - 6y + 9 = 0$, showing all relevant features. **3**

3.

(i) Solve the equation: $x^2 - 8x + 14 = 0$. **2**

(ii) Show that $y = x^2 - 8x + 14$ has a vertex at $(4, -2)$. **1**

(iii) Hence or otherwise sketch $f(x) = x^2 - 8x + 14$ for $x \geq 4$. **2**

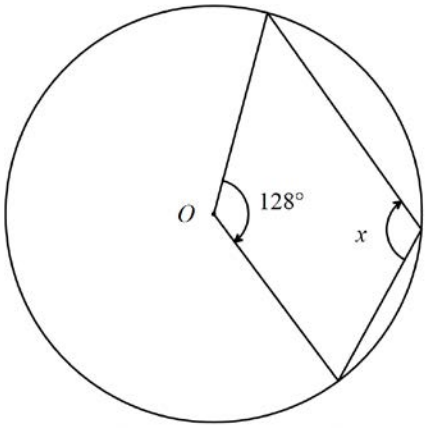
(iv) Given that $f^{-1}(x)$ is the inverse function of $f(x)$, find the point of intersection of $f(x)$ and $f^{-1}(x)$. **2**

Section F – Plane and Circle Geometry (16 Marks) Start a **NEW** page

1. Find the values of the pronumerals in each of the following:

REASONS MUST BE GIVEN!

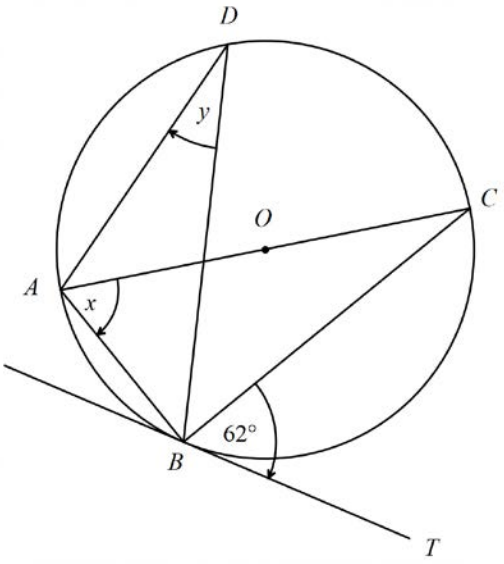
(i)



2

AC is the diameter. *BT* is tangent.

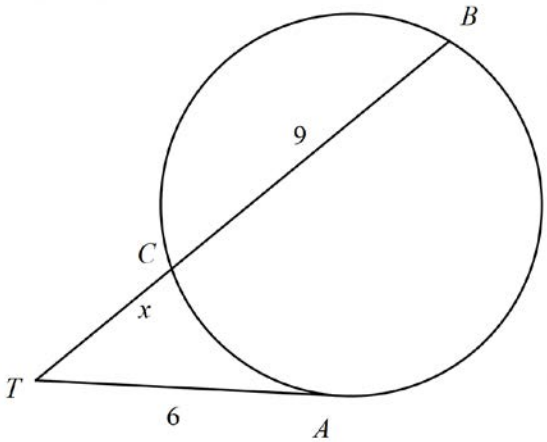
(ii)



4

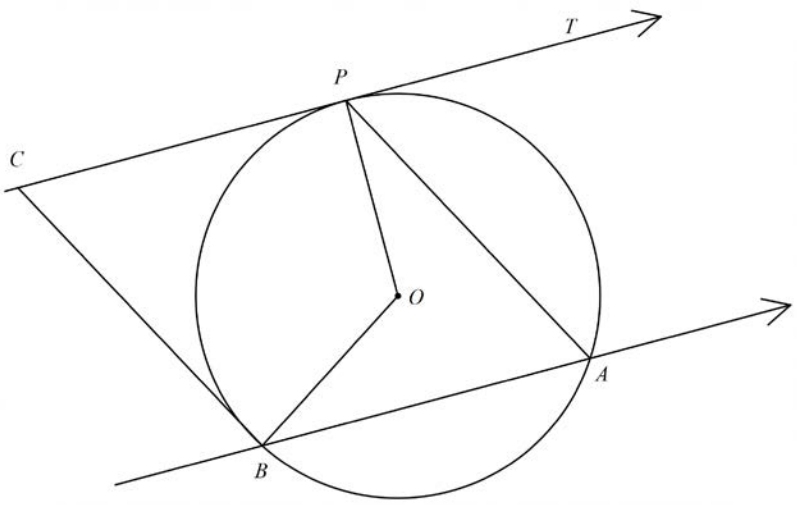
AT is a tangent. *AT* = 6 , *BC* =9 and *CT* = *x*

(iii)



2

2. *CT* is a tangent to the circle , centre *O*, touching at *P*. Quadrilateral *PABC* is a parallelogram and *CT* is parallel to *AB*.

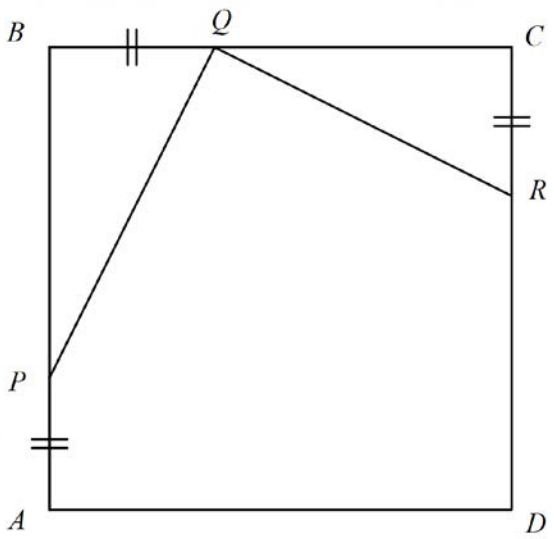


Full geometrical reasoning must be given for this question

(i) Let $\angle TPA = x$ and prove that $\angle POB = 2x$ **2**

(ii) Find the values of *x* such that POBC is a cyclic quadrilateral **2**

3.



ABCD is a square. The points *P, Q,* and *R* line on *AB, BC* and *CD* respectively so that $AP = BQ = CR$

(i) Prove that $\Delta PBQ \equiv \Delta QCR$ **2**

(ii) Prove that *PQ* is perpendicular to *QR* **2**

Section G – Logarithms (14 Marks) Start a **NEW** page

1. Evaluate each of the following:

(i) $\log_2 64$ **1**

(ii) $\log_a \sqrt{a}$ **1**

(iii) $\log_a \frac{1}{a^2}$ **1**

2. If $\log_x 2 = 6.1$ and $\log_x 5 = 2.9$, evaluate each of the following:

(i) $\log_x 10$ **1**

(ii) $\log_x 2.5$ **1**

(iii) $\log_x 50$ **1**

3. Solve for x:

(i) $4^x = 100$ **2**

(ii) $\log_a(4x) - \log_a(3) = \log_a(x+4)$ **3**

4. Draw a neat sketch of $y = \log_3 x$ showing all relevant features. **3**

Section H – Polynomials (14 Marks) Start a **NEW** page

1. Find the quotient and remainder when $(2x^3 + 4x^2 - x + 5)$ is divided by $(x+2)$ **3**

2. The polynomial $P(x) = 2x^3 + bx^2 - 8x + 5$ has a remainder of 2 when divided by $(x+3)$,

(i) Evaluate b **1**

(ii) Find the remainder when $P(x)$ is divided by $(x+2)$. **1**

3. Fully factorise $x^3 - 3x^2 - 10x + 24$ **3**

4.

(i) Sketch $P(x) = (x+2)(x-4)^2$ **3**

(ii) On a separate set of axes sketch $y = -2P(x)$ **2**

(iii) Hence or otherwise solve $(x+2)(x-4)^2 \geq 0$ **1**

Section A

1.

$x^2 = 3.04^2 + 5.32^2 - 2 \times 3.04 \times 5.32 \times \cos 122°$

$\therefore x = 7.39\,\text{cm}$

2.

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

$$30 = \frac{1}{2} \times 8 \times 11 \times \sin \angle BAC$$

$$\sin \angle BAC = \frac{30}{\frac{1}{2} \times 8 \times 11}$$

$\therefore \quad \angle BAC = 43°$ or $137°$

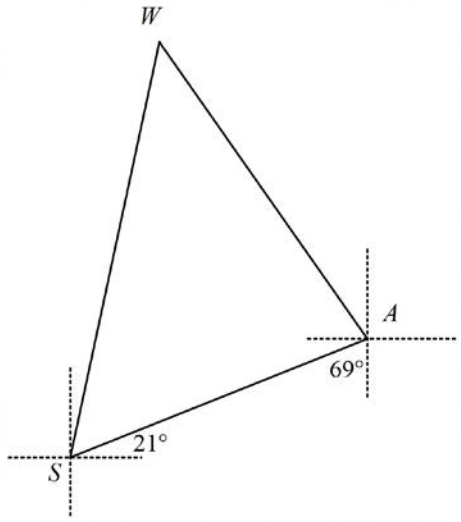
3.

(i) $90°$

(ii) $WS^2 = 18^2 + 13^2$

$\therefore WS = 22.20\,m$

(iii)



$$\tan \angle WSA = \frac{18}{13}$$

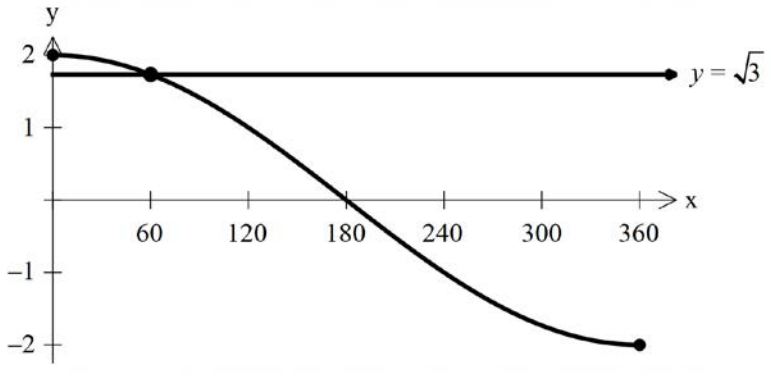
$\therefore \quad \angle WSA = 54°$

$\therefore$ bearing $= 90° - (54° + 21°)$

$= 015°T$

4.

(i)



(ii) 1 solution

	Section B
1.	1.57×10^{-5}
2.	$\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}} \times \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}} = \frac{(\sqrt{3}+\sqrt{2})^2}{3-2}$ $= 3 + 2\sqrt{6} + 2$ $= 2\sqrt{6} + 5$ $a = 2,\ b = 6\ ,\ c = 5$
3. (i) (ii) (iii)	$3x^2 - 12 = 3(x^2 - 4)$ $= 3(x-2)(x+2)$ $x^3 + 64 = (x+4)(x^2 - 4x + 16)$ $6x^2 - 25x + 14 = (3x-2)(2x-7)$
4.	Volumes 125 : 2744 SIdes 5 : 14 Areas 25 : 196 $\frac{25}{196} = \frac{75}{x}$ $25x = 14700$ $\therefore\ x = 588\,\text{cm}^2$
5.	$\frac{\frac{a+b}{b}+\frac{a+b}{a}}{\frac{a}{b}-\frac{b}{a}} = \frac{\frac{a^2+ab+ba+b^2}{ab}}{\frac{a^2-b^2}{ab}}$ $= \frac{(a+b)^2}{(a-b)(a+b)}$ $= \frac{a+b}{a-b}$

Section C

1.

$$PA = PB$$

$$\sqrt{(x+2)^2 + (y+3)^2} = \sqrt{(x-2)^2 + (y-5)^2}$$

$$x^2 + 4x + 4 + y^2 + 6y + 9 = x^2 - 4x + 4 + y^2 - 10y + 25$$

$$8x + 16y - 16 = 0$$

$$x + 2y - 2 = 0$$

2.

(i) $A = (-3, 0)$

$B = (0, -2)$

(ii) $C = (3, -4)$

(iii)

$$2x + 3y + 6 = 0$$

$$3y = -2x - 6$$

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

$\therefore \quad m_1 = -\frac{2}{3}$

$\therefore \quad m_2 = \frac{3}{2}$

$$y - y_1 = m(x - x_1)$$

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

$$2y + 8 = 3x - 9$$

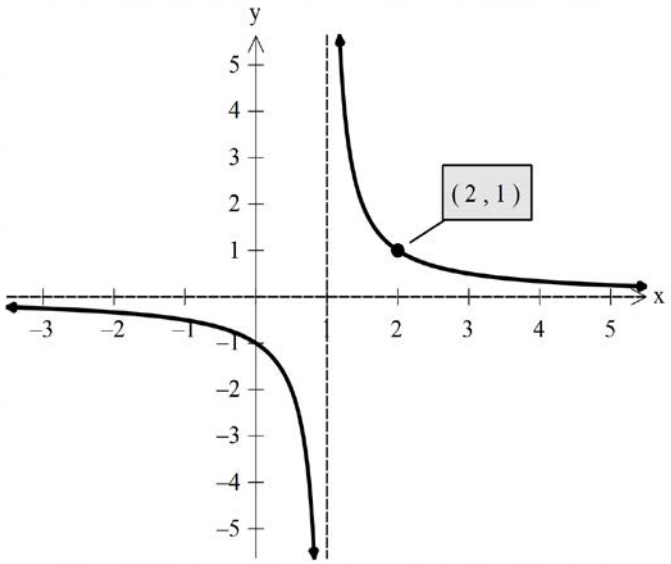
$$3x - 2y - 17 = 0$$

	Section D
1. (i) (ii) (iii)	$\frac{13}{52} \times \frac{12}{51} = \frac{1}{17}$ $1 \times \frac{12}{51} = \frac{4}{17}$ $\frac{1}{52} \times \frac{12}{51} + \frac{12}{52} \times \frac{1}{51} = \frac{2}{221}$
2	$1 - \left(\frac{5}{6}\right)^3 = \frac{91}{216}$
3. (i) (ii)	$15 \times 32.74 \times 12 \times 3 = \$17679.60$ $I = A - P$ $= 17679.60 - 15000$ $= 2679.60$ $I = Prn$ $r = \frac{I}{Pn}$ $= \frac{2679.60}{15000 \times 3}$ $= 0.0594666...$ $= 5.95\%$

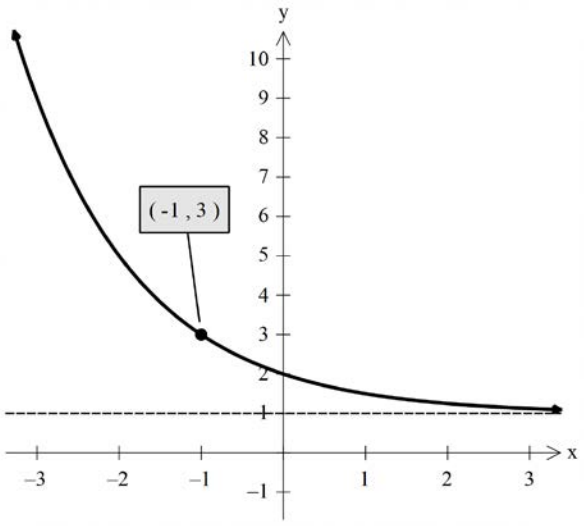
Section E

1.

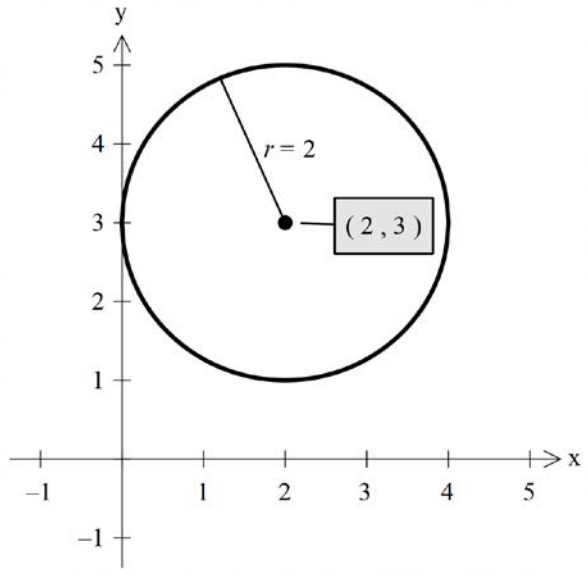
(i)



(ii)



2.



3.

(i)

$x^2 - 8x + 14 = 0$

$x^2 - 8x = -14$

$x^2 - 8x + 16 = -14 + 16$

$(x-4)^2 = 2$

$x - 4 = \pm\sqrt{2}$

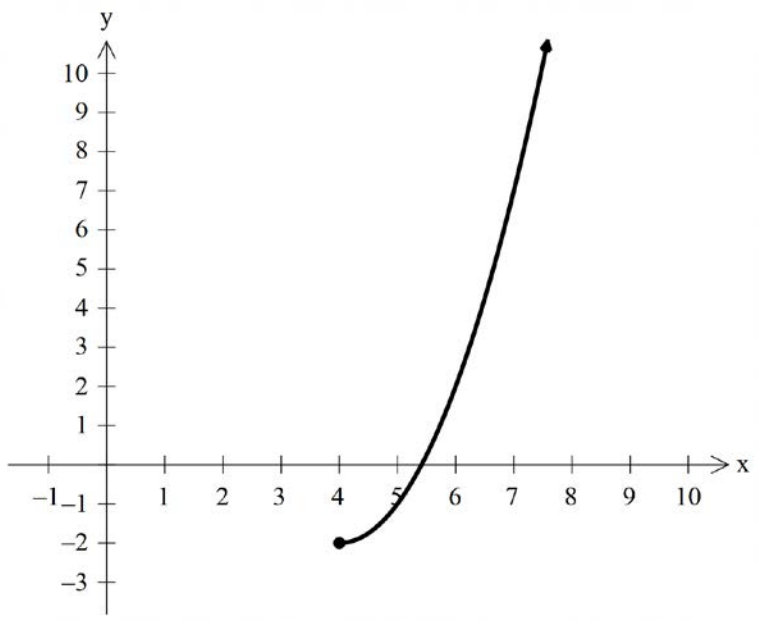
$x = 4 \pm \sqrt{2}$

$$-\frac{b}{2a} = \frac{8}{2}$$

$$= 4$$

$4^2 - 8 \times 4 + 14 = -2$

$\therefore$ vertex is (4,–2)



$x^2 - 8x + 14 = x$

$x^2 - 9x + 14 = 0$

$(x-7)(x-2) = 0$

$\therefore \quad x = 7$ (as x=2 is outside the domain)

$\therefore$ they intersect at (7,7)

Section F

1.

(i) $x = \dfrac{360 - 128^\circ}{2}$ (angle sum of a revolution and angle at the cirumference half the angle at the centre)

$= 116^\circ$

(ii) $x = 62^\circ$ (alternate segment theorem)

$\angle ABC = 90^\circ$ (angle in a semi circle)

$\angle ACB = 180^\circ - 90^\circ - 62^\circ$ (angle sum of ΔABC)

$= 28^\circ$

$\therefore \quad y = 28^\circ$ (angles standing on the same arc)

(iii) $x(x + 9) = 6^2$ (product of tangent and secant)

$x^2 + 9x = 36$

$x^2 + 9x - 36 = 0$

$(x + 9)(x - 3) = 0$

$x = -9$ or $x = 3$

$\therefore \quad x = 3$ (as $x > 0$)

2.

(i) $\angle BAP = \angle TPA$ (alternate angles, AB||CT)

$= x$

$\angle POB = 2x$ (angle at the centre twice angle at the circumference)

(ii) $\angle POB = \angle BAP$ (opposite angles of parallelogram are equal)

$= x$

$\angle POB + \angle PCB = 180^\circ$ (opposite angles of cyclic quadrilateral are supplentary)

$x + 2x = 180^\circ$

$3x = 180^\circ$

$x = 60^\circ$

3.

(i)

AB = CB (sides of square)

AP = BQ (given)

$\therefore$ AB – AP = CB – BQ

$\therefore$ BP = QC ①

in ΔPBQ & ΔQCR

BQ = CR (given)

BP = QC (from ①)

$\angle PBQ = \angle QCR$ (vertices of a square are all equal)

$\therefore$ $\Delta PBQ \equiv \Delta QCR$ (SAS)

(ii)

let $\angle BPQ = x$

$\therefore$ $\angle BQP = 180° - 90° - x$ (angle sum of right angled triangle)

$= 90° - x$

$\angle CQR = \angle BPQ$ (matching sides in congruent triangles)

$= x$

$\angle BQP + \angle PQR + \angle CQR = 180°$ (angle sum of a straight line)

$90° - x + \angle PQR + x = 180°$

$\angle PQR = 180° - 90°$

$= 90°$

$\therefore$ PQ $\perp$ QR

Section G

1.

(i) 6

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

(iii) -2

2.

(i) 9

(ii) -3.2

(iii) 11.9

3.

(i)

$$4^x = 100$$

$$\log(4^x) = \log(100)$$

$$x\log(4) = \log(100)$$

$$x = \frac{\log(100)}{\log(4)}$$

$$= 3.32\ (2\ d.p.)$$

(ii)

$$\log_a(4x) - \log_a(3) = \log_a(x+4)$$

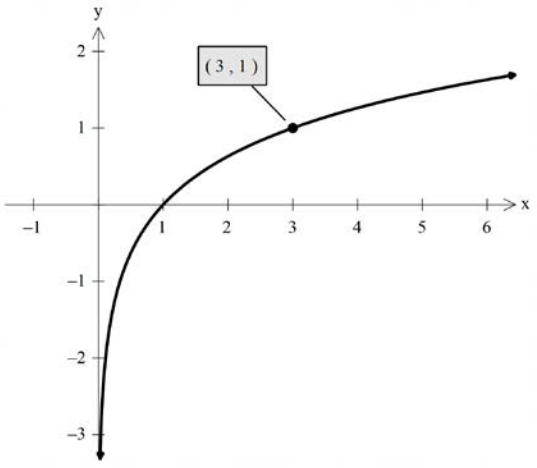
$$\log_a\left(\frac{4x}{3}\right) = \log_a(x+4)$$

$$\frac{4x}{3} = x + 4$$

$$4x = 3x + 12$$

$$x = 12$$

4.



Section H

1.

$$
\begin{array}{r}
2x^2 + 0x - 1 \\
x + 2 \overline{)\ 2x^3 + 4x^2 - x + 5} \\
2x^3 + 4x^2 \\
\hline
0x^2 - x \\
0x^2 - 0x \\
\hline
-x + 5 \\
-x - 2 \\
\hline
7
\end{array}
$$

$\therefore$ quotient $= 2x^2 - 1$

remainder $= 7$

2.

(i)

$$2(-3)^3 + b(-3)^2 - 8(-3) + 5 = 2$$

$$-54 + 9b + 24 + 5 = 2$$

$$9b = 27$$

$$b = 3$$

(ii)

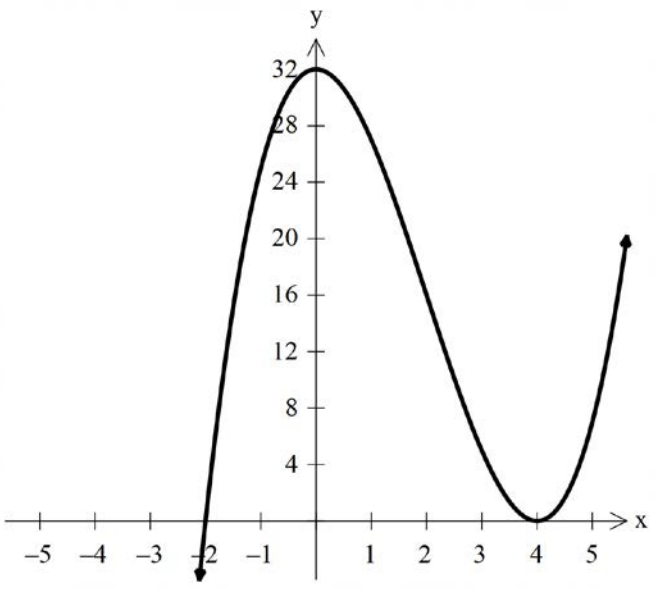
$$P(-2) = 2(-2)^3 + 3(-2)^2 - 8(-2) + 5$$

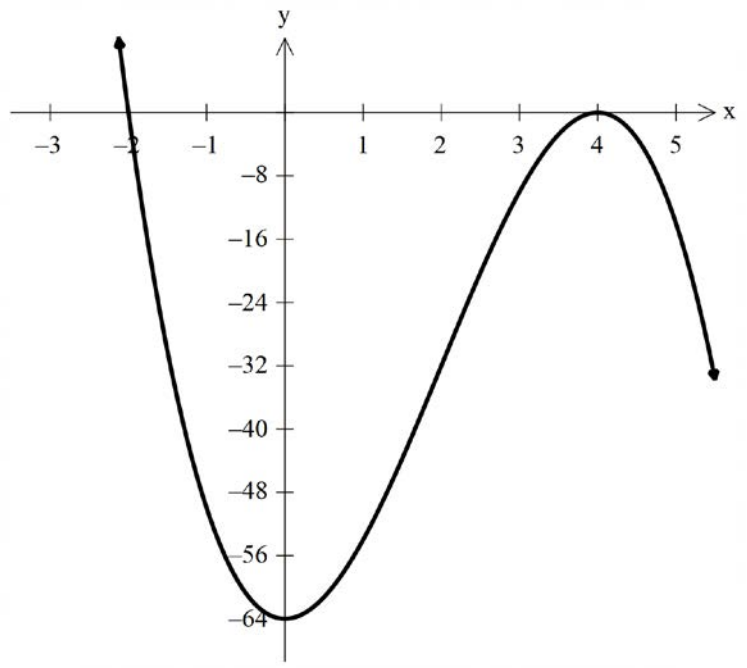
$$= 17$$

3. $x^3 - 3x^2 - 10x + 24 = (x + 3)(x - 2)(x - 4)$

4.

(i)



(ii)	 y x −3 −2 −1 1 2 3 4 5 −8 −16 −24 −32 −40 −48 −56 −64
(iii)	$x \geq -2$