Your Mathematics Class (Tick the box)	
10MaA Mr Fuller	
10MaB Ms Ward	
10MaC Mr Boros	
10MaD Ms Evans	
10MaE Mr McQuillan	
10MaF Mr Gainford	

Marker Use Only

Section	Mark
A	**/20**

Question 1 (20 marks) Answers   Marks

(a) Simplify:

   (i) $3k + 2 + k$ [1]

   (ii) $\dfrac{3a}{8} + \dfrac{a}{4}$ [1]

(b) Find 8% of $2 700.   [1]

(c) Simplify:

   (i) $\dfrac{\sqrt{130}}{\sqrt{5}}$ [1]

   (ii) $\dfrac{4 + 8m}{4}$ [1]

(d) Factorise $ab + 2a^2$.   [1]

(e) Solve $4t - 1 = \frac{1}{2}$.   [1]

(f) Evaluate $\dfrac{\sqrt{22\,500}}{2 \cdot 5 \times 6 \cdot 4}$.   [1]

(g) Simplify $\dfrac{(a^4)^4}{a^2}$ [1]

(h) Solve simultaneously   [1]

$$y = 2 \quad \text{and}$$
$$y + 6 = 2x$$

(i) Find $\tan 124°15'$ to one decimal place. $\boxed{1}$
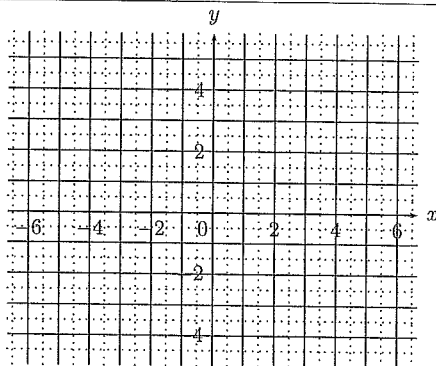
(j) (i) Solve $-2x + 1 > 5$. $\boxed{1}$

(ii) Graph the solution set on a number-line. $\boxed{1}$

(k) Sketch the graphs of:
(i) $y = x^2 + 1$ $\boxed{1}$

(ii) $y = \dfrac{4}{x}$ $\boxed{1}$

(l) Evaluate $10 - 2x^2$ when $x = -1$. $\boxed{1}$

(m) Express $x\%$ of \$$m$ in cents. $\boxed{1}$

(n) Simplify $8n^2 \div 4n^{-2}$. $\boxed{1}$

(o) If $\sin \theta = 0\cdot 147$ and θ is acute, find θ to the nearest minute. $\boxed{1}$

(p) Solve $2m^2 = 18$. $\boxed{1}$

End of Section A

![Crest]

SYDNEY BOYS HIGH
MOORE PARK, SURRY HILLS

2006
YEAR 10 YEARLY EXAMINATION

Advanced Mathematics

Directions to Candidates:

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- Full marks may not be awarded for careless or badly arranged work.

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- If additional working space .is needed, use the spare pages at the end of the booklet. Show clearly which question you are continuing.

- Board-approved calculators may be used.

Time allowed: 2 Hours
Examiner: Mr C. Kourtesis

Name: _____

Your Mathematics Class (Tick the box)	
10MaA Mr Fuller	
10MaB Ms Ward	
10MaC Mr Boros	
10MaD Ms Evans	
10MaE Mr McQuillan	
10MaF Mr Gainford	

Marker Use Only

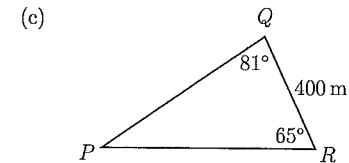| Section	Mark
B	**/20**

Question 2 (20 marks) <div align="right">Answers</div>

(a) Theo invested \$8 000 for a period of four years to earn compound interest of 8% p.a. What is the amount of interest that Theo will earn? $\boxed{2}$

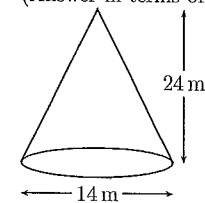(b) Solve the equation $(2m + 1)(4 - m) = 0$. $\boxed{1}$

(c) $\boxed{2}$

Use the Sine rule to calculate the length of the side PQ correct to the nearest metre.

(d) Find the area of the curved surface of the cone. (Answer in terms of π.) $\boxed{2}$

(e) If $V = \dfrac{G^2 h}{4\pi}$ $(G > 0)$, $\boxed{2}$

express this with G as the subject.

(f) A sphere has a diameter of $10\,$cm. Find the
 (i) volume (in terms of π), $\boxed{1}$

 (ii) surface area (in terms of π). $\boxed{1}$

(g)

Find the ratio of areas, $\triangle ABC : \triangle DEC$.

_____

(h) A circle has the equation

$$(x-4)^2 + (y+5)^2 = 100$$
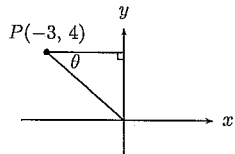
Find the
(i) coördinates of the centre, _____

(ii) radius. _____

(i) If $\sqrt{A} = n + 4$, find the value of $3A$.

_____

(j)

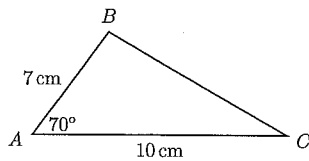Find the exact value of $\cos\theta + \sin\theta$.

_____

(k)

Use the Cosine rule to find the length of BC
(correct to 2 dec. pl.).

_____

End of Section B

Advanced Mathematics

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Time allowed: 2 Hours
Examiner: Mr C. Kourtesis

Name: _____

Your Mathematics Class (Tick the box)	
10MaA Mr Fuller	
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10MaC Mr Boros	
10MaD Ms Evans	
10MaE Mr McQuillan	
10MaF Mr Gainford	

Marker Use Only

Section	Mark
C	**/20**

Question 3 (20 marks)   Answers

(a)

7 cm   8 cm
θ 61°

Find the size of θ (to the nearest degree).

     [2]

(b) Two similar rectangles have areas of $160\,cm^2$ and $90\,cm^2$.

  (i) Express the ratio of these areas in simplest form.

     [1]

  (ii) What is the ratio of the sides of the two rectangles?

     [1]

(c) A square pyramid has a base of 10 cm and vertical height of 12 cm.
Find the:

  (i) volume of the pyramid,

     [1]

  (ii) surface area of the pyramid.

     [3]

(d) Light travels at $3 \times 10^8\,m/s$. How many kilometres does light travel in one hour?
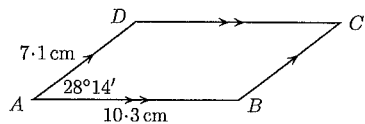
     [1]

(e) Use the quadratic formula to solve the equation $2x^2 - 5x - 1 = 0$ (answer in exact form). $\boxed{2}$

(f) Find the area of the parallelogram $ABCD$. $\boxed{3}$

(g) If $(x+2)(x+k) \equiv x^2 + nx + 8$, find the values of k and n. $\boxed{2}$

(h) Simplify $\dfrac{2^{-1} + 5^{-1}}{2^{-1} - 5^{-1}}$. $\boxed{2}$

(i) Express with a rational denominator $\boxed{2}$

$$\frac{2}{\sqrt{5} - 3}$$

End of Section C

SYDNEY BOYS HIGH

MOORE PARK, SURRY HILLS

2006

YEAR 10 YEARLY EXAMINATION

Advanced Mathematics

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Time allowed: 2 Hours
Examiner: Mr C. Kourtesis

Name: _____

Your Mathematics Class (Tick the box)	
10MaA Mr Fuller	
10MaB Ms Ward	
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10MaD Ms Evans	
10MaE Mr McQuillan	
10MaF Mr Gainford	

Marker Use Only

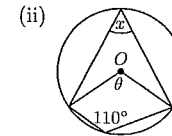| Section	Mark
D	**/20**

Question 4 (20 marks) Answers
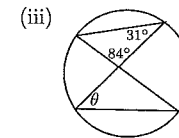
(a) Find the values of the pronumerals in each case. (Do NOT give reasons.) In each diagram O is the centre of the circle.
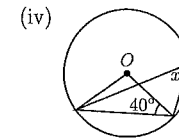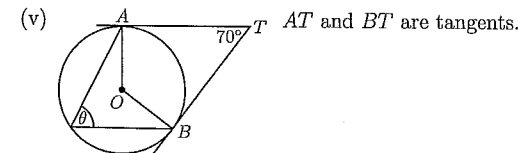
(i)

2

(ii)

2

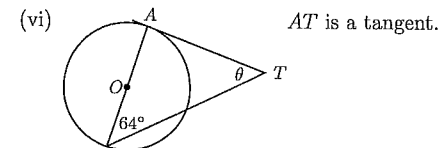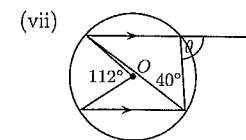(iii)

2

(iv)

2

(v) AT and BT are tangents.

2

(vi) AT is a tangent.

2

(vii)
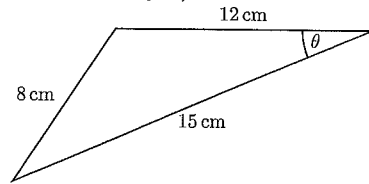

2

(b) Use the Cosine rule to find the size of θ (correct to the nearest degree).

$\boxed{3}$

(c) The surface area of two similar solids is in the ratio $4 : 9$. If the volume of the larger one is $243\,\text{cm}^3$, find the volume of the smaller one.

$\boxed{3}$

End of Section D

Advanced Mathematics

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- Board-approved calculators may be used.

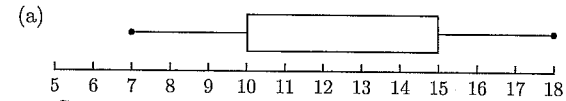Time allowed: 2 Hours
Examiner: Mr C. Kourtesis

Name: _____

Your Mathematics Class (Tick the box)	
10MaA Mr Fuller	
10MaB Ms Ward	
10MaC Mr Boros	
10MaD Ms Evans	
10MaE Mr McQuillan	
10MaF Mr Gainford	

Marker Use Only

Section	Mark
E	**/20**

Question 5 (20 marks)   Answers

(a)

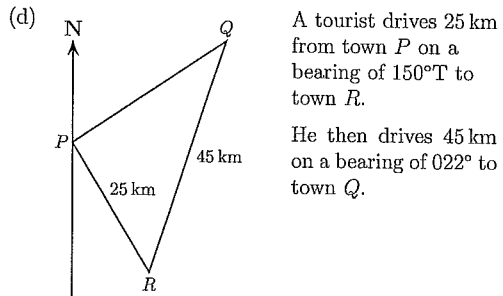Consider the *box-and-whisker* diagram above.

Find the:

(i) interquartile range, _____ $\boxed{1}$

(ii) percentage of the scores that are from 3 to 15. _____ $\boxed{1}$

(b) Given the following two sets of scores:

A : 80 75 70 65 60
B : 72 71 70 69 68

(i) Find the mean and standard deviation in each case. $\boxed{4}$

(ii) Which is the better result, a score of 75 from A or 72 from B? Give reasons. $\boxed{2}$

(c) What restrictions are there on x in each of the following?

(i) $\dfrac{x+4}{1-6x}$ $\boxed{1}$

(ii) $\sqrt{N^2 - 4x}$ $\boxed{1}$

(d)

A tourist drives 25 km from town P on a bearing of 150°T to town R.

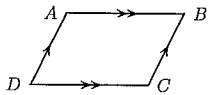He then drives 45 km on a bearing of 022° to town Q.

(i) Find the size of $\angle PRQ$. $\boxed{1}$

(ii) Calculate the distance of town Q from town P to the nearest kilometre. $\boxed{2}$

(e) If $A(5, k)$, $B(2, 7)$, $C(2, 1)$ are vertices of a triangle, find the area of the triangle. $\boxed{3}$

(f) Find the next term of the sequence $1, 9, 35, 91, \ldots$ $\boxed{2}$

(g) $ABCD$ is any parallelogram where $\sin A = k$. $\boxed{1}$

Find $\sin B$.

(h) Simplify $\dfrac{m(m - c) - 3(c - m)}{m^2 - c^2}$. $\boxed{1}$

End of Section E

Advanced Mathematics

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Time allowed: 2 Hours
Examiner: Mr C. Kourtesis

Name: _____

Your Mathematics Class (Tick the box)	
10MaA Mr Fuller	
10MaB Ms Ward	
10MaC Mr Boros	
10MaD Ms Evans	
10MaE Mr McQuillan	
10MaF Mr Gainford	

Marker Use Only

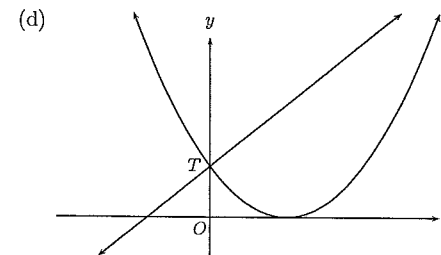| Section	Mark
F	**/20**

Question 6 (20 marks)   Answers

(a)   Find the value of x.   [2]

(b) (i) Expand and simplify $(x+y)^3$.   [1]
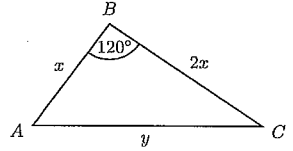
(ii) If $x+y=1$ and $x^3+y^3=19$, find the value of x^2+y^2.   [2]

(c) $ABCD$ is a square with point T inside the square such that
$DT = CT = DC$.
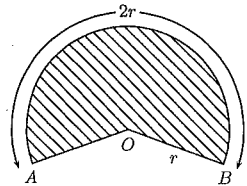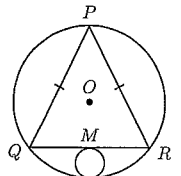Prove that triangle ATB is isosceles.   [3]

(d)   [2]

The diagram shows the graph of
$y = (x-c)^2$ and $y = x+t$, where C and t are positive. The graphs intersect on the y-axis at T. Find the equation relating c and t.

(e) A train left Sydney at r a.m. and arrived at its destination at t p.m. the same day. Find an expression for the number of hours taken.

$\boxed{1}$

(f)

$\boxed{3}$

In the triangle ABC, find the exact value of $\dfrac{x}{y}$.

(g) The diagram shows a major sector of a circle with centre O and radius r. Find the area of the shaded region.

$\boxed{3}$

(h)

A circle of radius 6 and centre O has an isosceles triangle PQR inscribed in it, where $PQ = PR$.
A second circle touches the first circle and the mid point of the base QR of the triangle as shown.
The side PQ has a length $4\sqrt{5}$.
M is the midpoint of QR.
Let $OM = x$ and $QR = 2y$.

(i) Explain why $x^2 + y^2 = 36$.

$\boxed{1}$

(ii) Find the radius of the smaller circle.

$\boxed{2}$

End of Section F

(a) Simplify:

  (i) $3k + 2 + k$

  $4k + 2$ [1]

  (ii) $\frac{3a}{8} + \frac{a}{4} = \frac{3a + 2a}{8}$ $\frac{5a}{8}$ [1]

(b) Find 8% of $2\,700.

  $216 [1]

(c) Simplify:

  (i) $\frac{\sqrt{130}}{\sqrt{5}}$ $\sqrt{26}$ [1]

  (ii) $\frac{4 + 8m}{4}$ $1 + 2m$ [1]

  or $2m + 1$ [1]

(d) Factorise $ab + 2a^2$.

  $a(b + 2a)$ [1]

(e) Solve $4t - 1 = \frac{1}{2}$. $8t - 2 = 1$ $t = \frac{3}{8}$ [1]

  $8t = 3$

(f) Evaluate $\frac{\sqrt{22\,500}}{2 \cdot 5 \times 6 \cdot 4}$. $9 \cdot 375 = \frac{75}{8}$ [1]

(g) Simplify $\frac{(a^4)^4}{a^2}$ a^{14} [1]

(h) Solve simultaneously [1]

$$y = 2 \quad \text{and}$$
$$y + 6 = 2x$$

  $2 + 6 = 2x$

  $2x = 8$

  $x = 4$ $(4, 2)$

(i) Find $\tan 124°15'$ to one decimal place. -1.5 [1]

(j) (i) Solve $-2x + 1 > 5$. $x < -2$ [1]

  $-2x > 4$ $x < -2$

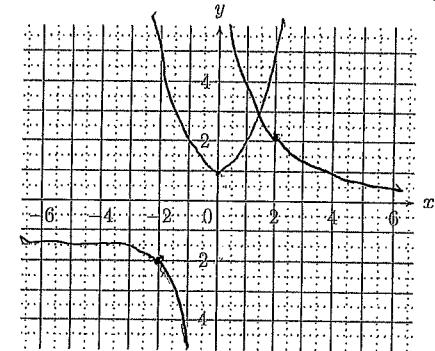 (ii) Graph the solution set on a number-line. [1]

(k) Sketch the graphs of:

  (i) $y = x^2 + 1$ [1]

  (ii) $y = \frac{4}{x}$ [1]

(l) Evaluate $10 - 2x^2$ when $x = -1$. 8 [1]

(m) Express $x\%$ of m in cents. [1]

  $100\left(\frac{mx}{100}\right) = mx$

(n) Simplify $8n^2 \div 4n^{-2}$. $\frac{8n^2}{4} \times n^2 = 2n^4$ [1]

(o) If $\sin \theta = 0 \cdot 147$ and θ is acute, find θ to the nearest minute. $8°27'$ [1]

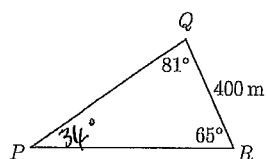(p) Solve $2m^2 = 18$. $m^2 = 9$ $m = \pm 3$ [1]

End of Section A

(a) Theo invested \$8 000 for a period of four years to earn compound interest of 8% p.a. What is the amount of interest that Theo will earn? ☐2

$$A = 8000(1.08)^4 = 10\,883.91 \qquad I = A - P = \$2883.91$$

(b) Solve the equation $(2m+1)(4-m) = 0$. ☐1
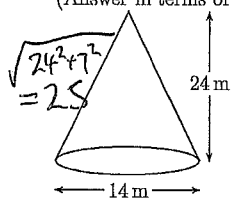
$$m = 4 \quad \text{or} \quad m = -\tfrac{1}{2}$$

(c) ☐2

Use the Sine rule to calculate the length of the side PQ correct to the nearest metre.

$$\frac{PQ}{\sin 65} = \frac{400}{\sin 34}$$

$$PQ = 648m$$

(d) Find the area of the curved surface of the cone. (Answer in terms of π.) ☐2

$$\sqrt{24^2 + 7^2} = 25$$

$$A = \pi r s$$
$$= \pi \times 7^2 \times 25$$
$$= 175\pi \ m^2$$

(e) If $V = \dfrac{G^2 h}{4\pi}$ $(G > 0)$, express this with G as the subject. ☐2

$$G = \sqrt{\frac{4\pi V}{h}}$$

(f) A sphere has a diameter of 10 cm. Find the
(i) volume (in terms of π), ☐1

$$V = \tfrac{4}{3}\pi r^3 = \tfrac{4}{3}\pi \times 5^3 = \frac{500\pi}{3} \ cm^3$$

(ii) surface area (in terms of π). ☐1

$$SA = 4\pi r^2 = 4 \times 5^2 \times \pi = 100\pi \ cm^2$$

(g) ☐2
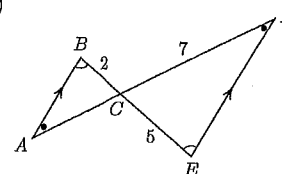

Find the ratio of areas, $\triangle ABC : \triangle DEC$.

$$2^2 : 5^2 = 4 : 25$$

(h) A circle has the equation

$$(x-4)^2 + (y+5)^2 = 100$$

Find the
(i) coördinates of the centre, $(4, -5)$ ☐1
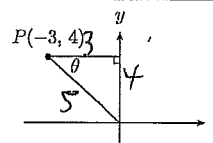(ii) radius. 10 ☐1

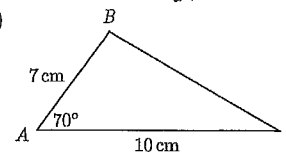(i) If $\sqrt{A} = n + 4$, find the value of $3A$. ☐2

$$3(n+4)^2 = 3n^2 + 24n + 48$$

(j) ☐2

Find the exact value of $\cos\theta + \sin\theta$.

$$\frac{adj}{hyp} + \frac{opp}{hyp} = \frac{3}{5} + \frac{4}{5} = \frac{7}{5}$$

(k) ☐1

Use the Cosine rule to find the length of BC (correct to 2 dec. pl.).

$$BC^2 = 7^2 + 10^2 - 2 \times 7 \times 10 \cos 70 \approx 101.117 \qquad BC \approx 10.06cm$$
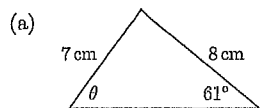
End of Section B

Question 3 (20 marks)   Answers

(a)

7 cm   8 cm
θ   61°

Find the size of θ (to the nearest degree).

$\dfrac{\sin\theta}{8} = \dfrac{\sin 61}{7}$ ½   [2]

$\sin\theta = \dfrac{8\sin 61}{7}$ ½ $\theta = 88°$ ½

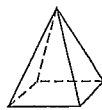$\theta = 88.31069363$ ½

(b) Two similar rectangles have areas of 160 cm² and 90 cm².

(i) Express the ratio of these areas in simplest form.   [1]

160 : 90

16 : 9 1

(ii) What is the ratio of the sides of the two rectangles?   [1]

4 : 3 1

(c)

A square pyramid has a base of 10 cm and vertical height of 12 cm. Find the:

(i) volume of the pyramid,   [1]

$V = \frac{1}{3} \times 12 \times 10^2$

$= 400 \text{ cm}^3$ 1

(ii) surface area of the pyramid.   [3]

height of △ $= \sqrt{5^2 + 12^2}$

$= 13$ 1

SA $= 10^2 + 4 \times \frac{1}{2} \times 10 \times 13$ 1

$= 360 \text{ cm}^2$ 1

(d) Light travels at 3×10^8 m/s. How many kilometres does light travel in one hour?   [1]

3×10^8 m/s
$= 3 \times 10^5$ km/s
1.8×10^7 km/m
1.08×10^9 km/hr. 1

(e) Use the quadratic formula to solve the equation $2x^2 - 5x - 1 = 0$ (answer in exact form).   [2]

$x = \dfrac{5 \pm \sqrt{(5)^2 - 4 \times 2 \times -1}}{2 \times 2}$ 1

$= \dfrac{5 \pm \sqrt{25 + 8}}{4}$

$x = \dfrac{5 \pm \sqrt{33}}{4}$ 1

(f) Find the area of the parallelogram $ABCD$.   [3]

7·1 cm
28°14'
10·3 cm

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

$= 2 \times \frac{1}{2} \times 7.1 \times 10.3 \times \sin 28°14'$ 1

$= 34.59512691$

$= 34.6 \text{ cm}^2$ (1d.p.) 1

(g) If $(x+2)(x+k) \equiv x^2 + nx + 8$, find the values of k and n.   [2]

$x^2 + 2k + 2x + 2k \equiv x^2 + nx + 8$

$x^2 + (k+2)x + 2k \equiv x^2 + nx + 8$ 1

∴ $2k = 8$
∴ $k = 4$. ½

$k + 2 = n$
∴ $n = 6$ ½.

(h) Simplify $\dfrac{2^{-1} + 5^{-1}}{2^{-1} - 5^{-1}}$.   [2]

$= \dfrac{\frac{1}{2} + \frac{1}{5}}{\frac{1}{2} - \frac{1}{5}}$ 1 $= \dfrac{\frac{7}{10}}{\frac{3}{10}}$

$= \frac{7}{3}, 2\frac{1}{3}, 2.3$ 1

(i) Express with a rational denominator   [2]

$\dfrac{2}{\sqrt{5} - 3}$ & $\dfrac{\sqrt{5} + 3}{\sqrt{5} + 3}$ 1

$\dfrac{2\sqrt{5} + 6}{5 - 9}$ $= \dfrac{-2\sqrt{5} + 6}{4}$ 1

1 only for $\times \dfrac{\sqrt{5} - 3}{\sqrt{5} - 3}$

½ only for $\times \dfrac{\sqrt{5}}{\sqrt{5}}$
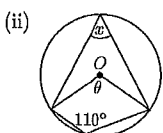
End of Section C

Question 4 (20 marks)

Answers

(a) Find the values of the pronumerals in each case. (Do NOT give reasons.) In each diagram O is the centre of the circle.
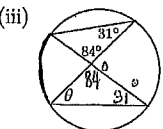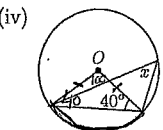
(i)

$x = 115°$ ①

$\theta = 100°$ ①

2

(ii)

$x = 70°$ ①

$\theta = 140°$ ①

2

(iii)

$\theta = 65°$ ②

2

(iv)

$x = 50°$ ②

2

(v)

AT and BT are tangents.

$\theta = 55°$ ②

2

(vi)

AT is a tangent.

$\theta = 26°$ ②

2

(vii)
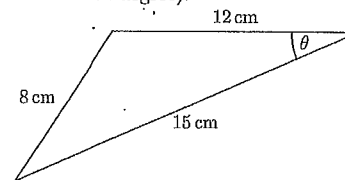

$\theta = 96°$

2

(b) Use the Cosine rule to find the size of θ (correct to the nearest degree).

$\cos\theta = \dfrac{12^2 + 15^2 - 8^2}{2 \times 12 \times 15}$

$= \dfrac{305}{360} = \dfrac{61}{72}$

$\theta \doteqdot 32°$ ③

$(32° 5' 21.06'')$

3

(c) The surface area of two similar solids is in the ratio 4 : 9. If the volume of the larger one is 243 cm³, find the volume of the smaller one.

$\left(\dfrac{\text{solid } A}{\text{solid } B}\right)^2 = \dfrac{4}{9} \Rightarrow \dfrac{\text{solid } A}{\text{solid } B} = \dfrac{2}{3}$

$\dfrac{\text{Vol solid } A \text{ smaller}}{243} = \left(\dfrac{2}{3}\right)^3$

$\text{Vol. smaller one} = \dfrac{8 \times 243}{27} = 72 \text{ cm}^3$ ③
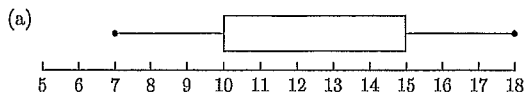
3

End of Section D

Question 5 (20 marks)   Answers

(a)

Consider the *box-and-whisker* diagram above.

Find the:

(i) interquartile range, _____ $15 - 10 = 5$ _____ [1]

(ii) percentage of the scores that are from 3 to 15. _____ 75% _____ [1]

(b) Given the following two sets of scores:

   $A: 80 \quad 75 \quad 70 \quad 65 \quad 60$
   $B: 72 \quad 71 \quad 70 \quad 69 \quad 68$

(i) Find the mean and standard deviation in each case. [4]

$$\overline{x}_A = 70 \qquad \sigma_A = 7.07$$
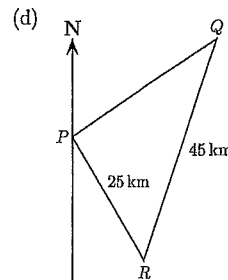$$\overline{x}_B = 70. \qquad \sigma_B = 1.41.$$

(ii) Which is the better result, a score of 75 from A or 72 from B? Give reasons. [2]

$$72 \text{ from } B \Rightarrow \;>1 \text{ S.D.}$$

(c) What restrictions are there on x in each of the following?

(i) $\dfrac{x+4}{1-6x}$ [1]

$$x \neq \frac{1}{6}.$$

(ii) $\sqrt{N^2 - 4x}$ [1]

$$x \leq \frac{N^2}{4}$$

(d)

A tourist drives 25 km from town P on a bearing of 150°T to town R.

He then drives 45 km on a bearing of 022° to town Q.

(i) Find the size of $\angle PRQ$. [1]

$$52°$$

(ii) Calculate the distance of town Q from town P to the nearest kilometre. [2]

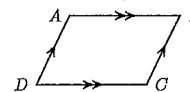$$\sqrt{45^2 + 25^2 - 2(45)(25)\cos 52} \doteqdot 36 \text{ KM}.$$

(c) If $A(5, k)$, $B(2, 7)$, $C(2, 1)$ are vertices of a triangle, find the area of the triangle. [3]

$$\frac{1}{2}(5-2)(7-1) = 9 \text{ units}^2.$$

(f) Find the next term of the sequence $1, 9, 35, 91, \ldots$ [2]

$$4^3 + 5^3 = 189.$$

(g) $ABCD$ is any parallelogram where $\sin A = k$. [1]

Find $\sin B$.

$$\sin B = \sin(180 - A)$$
$$= K$$
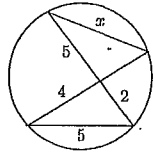
(h) Simplify $\dfrac{m(m-c) - 3(c-m)}{m^2 - c^2}$. [1]

$$\frac{(m+3)(m-c)}{(m+c)(m-c)} \;=\; \frac{3+m}{c+m}.$$

End of Section E

Answers

(a)

Find the value of x. $\boxed{2}$

$$\frac{x}{5} = \frac{5}{4}$$

$$x = \frac{25}{4}$$

(b) (i) Expand and simplify $(x+y)^3$. $\boxed{1}$

$(x+y)^3 = (x+y)^2(x+y)$
$= (x^2 + 2xy + y^2)(x+y)$
$= x^3 + 2x^2y + xy^2 + yx^2 + 2xy^2 + y^3$
$= x^3 + 3x^2y + 3xy^2 + y^3$

(ii) If $x+y = 1$ and $x^3 + y^3 = 19$, find the value of $x^2 + y^2$. $\boxed{2}$

$(x+y)^3 = x^3 + y^3 + 3xy(x+y)$
$(1)^3 = 19 + 3xy(1)$
$3xy = -18$
$xy = -6$

$(x+y)^2 = x^2 + 2xy + y^2$
$x^2 + y^2 = (x+y)^2 - 2xy$
$x^2 + y^2 = (1)^2 - 2(-6) = 13$

(c)

$ABCD$ is a square with point T inside the square such that $DT = CT = DC$. Prove that triangle ATB is isosceles. $\boxed{3}$
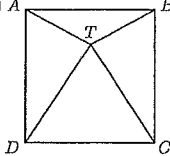
$DT = TC = DC$ (given)
$\therefore \triangle DTC$ is an equilateral
$\angle TDC = \angle TCD = 60°$ (angles in equilateral triangle)
$AD = BC$ (sides of square are equal)
$\angle ADC = \angle BCD = 90°$ (angles in a square are 90°)
$\therefore \angle ADT = \angle BCT = 30°$ (complementary angles)
$\therefore \triangle ADT \equiv \triangle BCT$ (SAS)
$\therefore AT = TB$ (corresponding sides of congruent triangles)
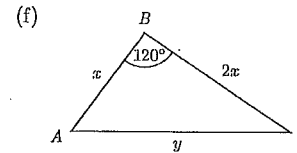$\therefore \triangle ATB$ is isosceles
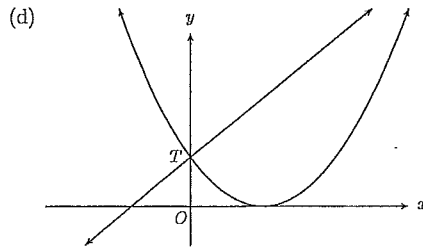
(d)

The diagram shows the graph of $y = (x-c)^2$ and $y = x + t$, where C and t are positive. The graphs intersect on the y-axis at T. Find the equation relating c and t. $\boxed{2}$

when $x = 0$
$y = c^2$ $y = t$
$\therefore t = c^2$

(e) A train left Sydney at r a.m. and arrived at its destination at t p.m. the same day. Find an expression for the number of hours taken. $\boxed{1}$

$12 - r + t$

(f)

In the triangle ABC, find the exact value of $\frac{x}{y}$. $\boxed{3}$

$y^2 = x^2 + (2x)^2 - 2(x)(2x)\cos 120°$
$y^2 = x^2 + 4x^2 - 4x^2(-\frac{1}{2})$
$y^2 = 7x^2$
$\frac{7x^2}{y^2} = 1$
$\frac{x^2}{y^2} = \frac{1}{7}$
$\therefore \frac{x}{y} = \frac{1}{\sqrt{7}}$ or $\frac{\sqrt{7}}{7}$ (take positive square root as x & y are lengths)

(g) The diagram shows a major sector of a circle with centre O and radius r. Find the area of the shaded region. $\boxed{3}$
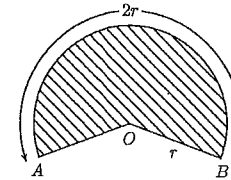
$A = \frac{2r}{2\pi r} \times \pi r^2$
$= r^2$ square units

(h)

A circle of radius 6 and centre O has an isosceles triangle PQR inscribed in it, where $PQ = PR$. A second circle touches the first circle and the mid point of the base QR of the triangle as shown. The side PQ has a length $4\sqrt{5}$. M is the midpoint of QR. Let $OM = x$ and $QR = 2y$.
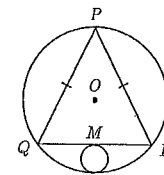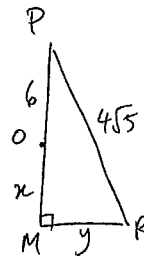
(i) Explain why $x^2 + y^2 = 36$. $\boxed{1}$

The line from the centre to bisect a chord is perpendicular to it. ie $OM \perp QR$
Using pythagoras theorem in $\triangle OMQ$
$OQ^2 = OM^2 + MQ^2$
$36 = x^2 + y^2$

(ii) Find the radius of the smaller circle. $\boxed{2}$

$(4\sqrt{5})^2 = (6+x)^2 + y^2$
$80 = 36 + 12x + x^2 + y^2$
$80 = 36 + 12x + 36$
$12x = 8$
$x = \frac{2}{3}$

$\therefore$ diameter of smaller circle is $6 - (\frac{2}{3}) = \frac{16}{3}$
$\therefore$ radius of smaller circle is $\frac{8}{3}$

End of Section F