SYDNEY BOYS HIGH
MOORE PARK, SURRY HILLS

2006
YEAR 10 YEARLY EXAMINATION

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)		
10Ma**A**	Mr Fuller	
10Ma**B**	Ms Ward	
10Ma**C**	Mr Boros	
10Ma**D**	Ms Evans	
10Ma**E**	Mr McQuillan	
10Ma**F**	Mr Gainford	

Marker Use Only

Section	Mark
A	/20

Marks

Question 1 (20 marks) Answers

(a) Simplify:

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

(ii) $\frac{3a}{8} + \frac{a}{-}$ [1]

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

(c) Simplify:

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

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

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

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

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

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

(h) Solve simultaneously [1]

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

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

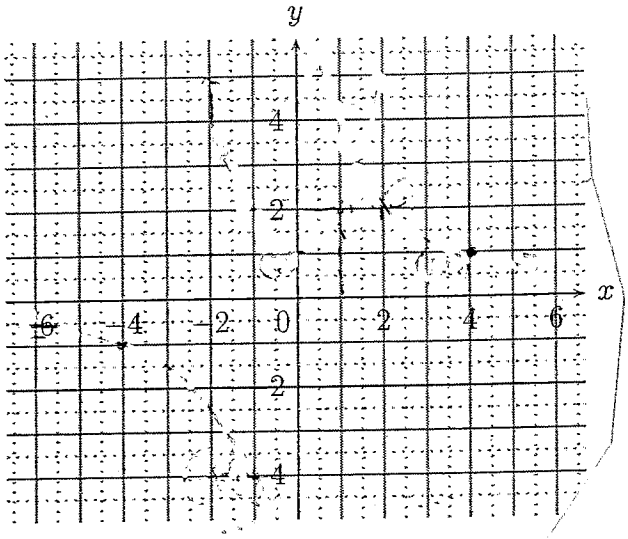
(j) (i) Solve $-2x + 1 > 5$. [1]

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

(k) Sketch the graphs of:

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

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



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

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

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

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

(p) Solve $2m^2 = 18$. [1]

End of Section A

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Marker Use Only

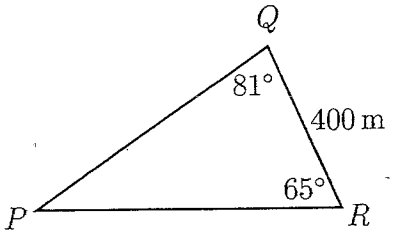
Section	Mark
B	/20

Question 2 (20 marks) Answers

(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

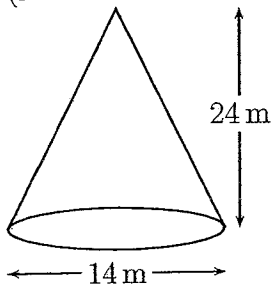
(b) Solve the equation $(2m+1)(4-m)=0$. 1

(c) 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.) 2



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

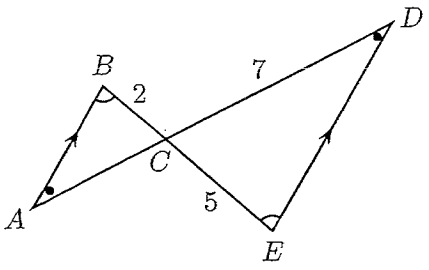
express this with G as the subject.

(f) A sphere has a diameter of 10 cm. Find the

(i) volume (in terms of π), 1

(ii) surface area (in terms of π). 1

(g)



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

2

(h) A circle has the equation

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

Find the

(i) coördinates of the centre, _____

1

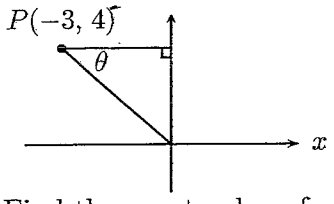
(ii) radius. _____

1

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

2

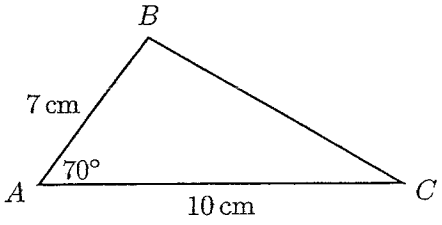
(j)



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

2

(k)



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

1

End of Section B

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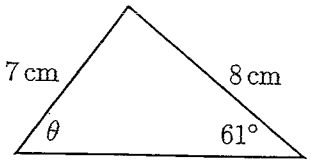
10MaD	Ms Evans	
10MaE	Mr McQuillan	
10MaF	Mr Gainford	

Marker Use Only

Section	Mark
C	/20

Question 3 (20 marks) Answers

(a)



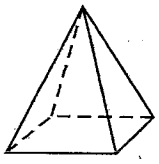
Find the size of θ (to the nearest degree). [2]

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

(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:

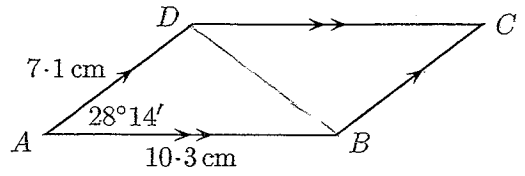
(i) volume of the pyramid, [1]

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

(d) Light travels at $3 \times 10^8\,\text{m/s}$. 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). [2]

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



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

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

(i) Express with a rational denominator [2]

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

End of Section C

Extra working page

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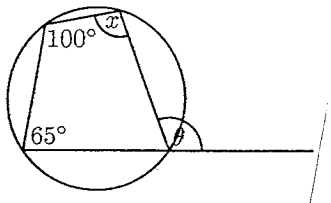
Marker Use Only

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) 

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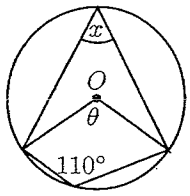
(ii) 

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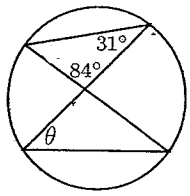
(iii) 

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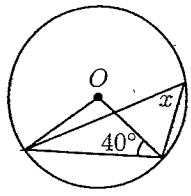
(iv) 

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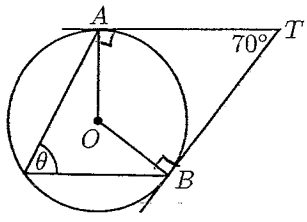
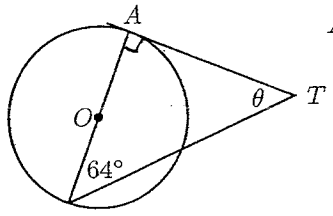
(v) 

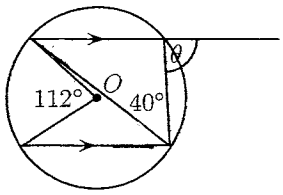
AT and BT are tangents.

2

(vi) 

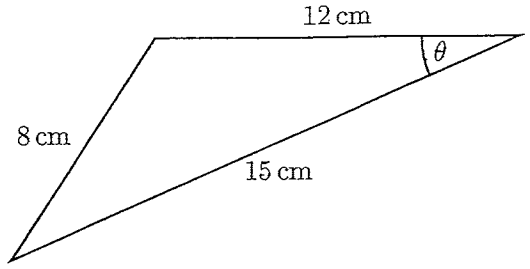
AT is a tangent.

2

(vii) 

2

(b) Use the Cosine rule to find the size of θ (correct to the nearest degree). 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. 3

End of Section D

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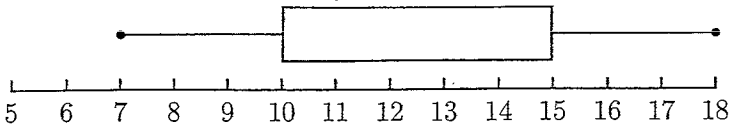
10Ma**E** Mr McQuillan	
10Ma**F** Mr Gainford	

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, _____ 1

(ii) percentage of the scores that are from 3 to 15. _____ 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. 4

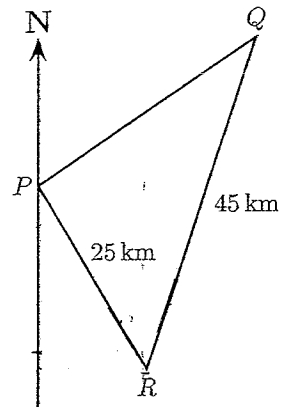
(ii) Which is the better result, a score of 75 from A or 72 from B? Give reasons. 2

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

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

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

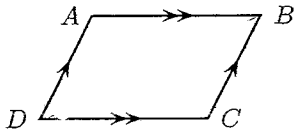
(i) Find the size of $\angle PRQ$. [1]

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

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

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

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



Find $\sin B$.

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

End of Section E

Extra working page

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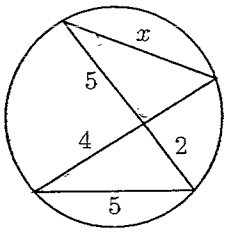
Marker Use Only

Section	Mark
F	/20

Question 6 (20 marks)

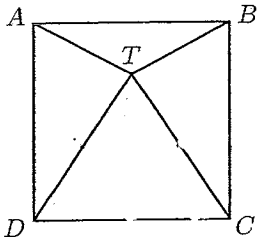
Answers

(a) 

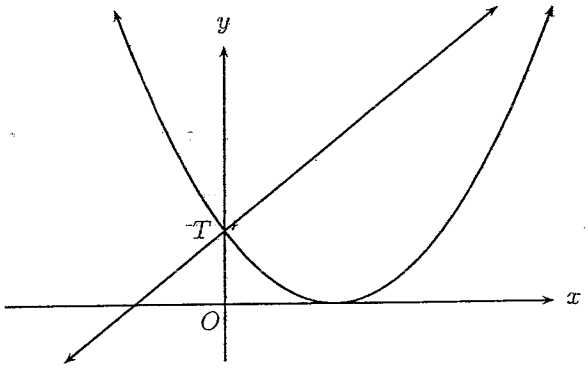
Find the value of x. [2]

(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) 

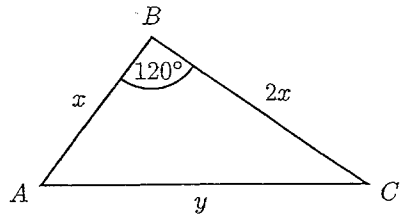
$ABCD$ is a square with point T inside the square such that $DT = CT = DC$. Prove that triangle ATB is isosceles. [3]

(d) 

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. [2]

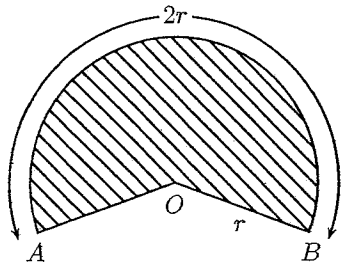
(e) A train left Sydney at r a.m. and arrived at its destination at t p.m. the same day. Find an expression for the number of hours taken. 1

(f) 3

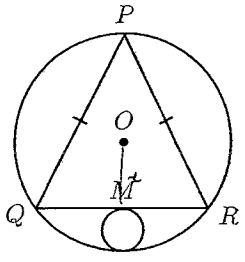


In the triangle ABC, find the exact value of $\frac{x}{y}$.

(g) The diagram shows a major sector of a circle with centre O and radius r. Find the area of the shaded region. 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 $x^2 + y^2 = 36$. 1

(ii) Find the radius of the smaller circle. 2

End of Section F

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Name: Stuart Sugito

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10MaE	Mr McQuillan	
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Marker Use Only

Section	Mark
A	19 /20

108·5

Marks

Question 1 (20 marks) Answers

(a) Simplify:

(i) $3k+2+k$ — $4k+2$ ✓ [1]

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

(b) Find 8% of \$2 700. — \$216 ✓ [1]

(c) Simplify:

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

(ii) $\frac{4+8m}{4}$ — $1+4m$ ✓ [1]

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

(e) Solve $4t-1=\frac{1}{2}$. — $4t=1\frac{1}{2}$ $t=\frac{3}{8}=0.375$ ✓ [1]

(f) Evaluate $\frac{\sqrt{22\,500}}{2\cdot5\times6\cdot4}$ — $\frac{150}{16}$ $\frac{75}{8}=9.375$ ✓ [1]

(g) Simplify $\frac{(a^4)^4}{a^2}$ — $\frac{a^{16}}{a^2}=a^{14}$ ✓ [1]

(h) Solve simultaneously [1]

$y=2$ and
$y+6=2x$

$2+6=2x$
$8=2x$
$x=4$ ✓

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

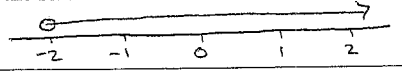
-1.5

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

$-2x > 4$

$x < -2$

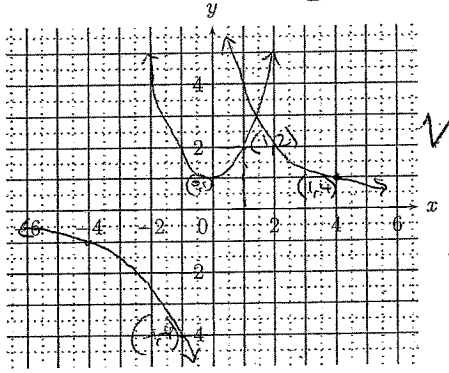
(ii) Graph the solution set on a number-line. [1]



(k) Sketch the graphs of:

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

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



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

$10 - 2(-1)^2 = 8$

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

mx cents

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

$2n^4$

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

$8^\circ\ 27'$

(p) Solve $2m^2 = 18$. [1]

$m^2 = 9$ $\quad m = 3$

End of Section A

SYDNEY BOYS HIGH
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Examiner: Mr C. Kourtesis

Name: Stuart Sugito

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10MaA	Mr Fuller	
10MaB	Ms Ward	✓
10MaC	Mr Boros	
10MaD	Ms Evans	
10MaE	Mr McQuillan	
10MaF	Mr Gainford	

Marker Use Only

Section	Mark
B	$19\frac{1}{2}$ /20

Question 2 (20 marks)

Answers

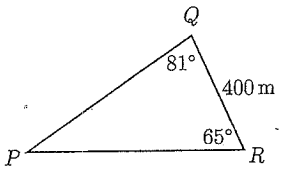
(a) Theo invested \$8 000 for a period of four years to earn compound interest of 8% p.a. What is the amount of interest that Theo will earn? [2]

$A = 8000(1.08)^4$ $I = \$2\,883.91$

(b) Solve the equation $(2m+1)(4-m)=0$. [1]

$m = -\frac{1}{2}$ or 4

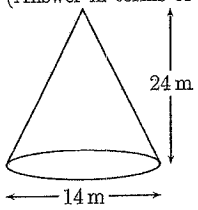
(c) [2]



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

$\frac{PQ}{\sin 65} = \frac{400}{\sin 34}$ $PQ = 648\text{m}$

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



$SA = \pi rs$

$24^2 + 7^2 = s^2$

$s = 25$

$SA = (7)(25)\pi$

$SA = 175\pi$

(e) If $V = \frac{G^2 h}{4\pi}$ $(G \geq 0)$, express this with G as the subject. [2]

$4\sqrt{\pi} = G^2 h$

$\frac{4\sqrt{\pi}}{h} = G^2$

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

(f) A sphere has a diameter of 10 cm. Find the [1]

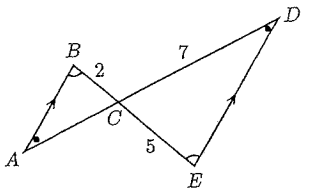
(i) volume (in terms of π),

$166\frac{2}{3}\pi$ [1]

(ii) surface area (in terms of π).

100π

(g) [2]



$2:5$

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

ratio of side = 2:5

ratio of areas = 4:25

(h) A circle has the equation [1]

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

Find the

(i) coördinates of the centre, $(4, -5)$ [1]

(ii) radius. 10 [1]

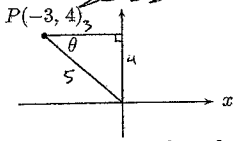
(i) If $\sqrt{A} = n+4$, find the value of $3A$. [2]

$A = n^2 + 8n + 16$

$3A = 3n^2 + 24n + 48$

$3A = (3n+12)(n+4)$

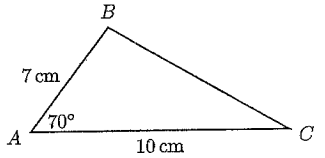
(j) [2]



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

$\frac{3}{5} + \frac{4}{5} = \frac{7}{5} = 1\frac{2}{5}$

(k) [1]



$BC^2 = 7^2 + 10^2 - 2(7)(10)\cos 70$

$= 101.12$ (2dec)

$BC = 10.06\text{cm}$

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

$BC = 10.06\text{cm}$

End of Section B

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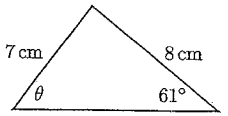
Section	Mark
C	20/20

Question 3 (20 marks) Answers

(a)



Find the size of θ (to the nearest degree). [2]

$\frac{7}{\sin 61} = \frac{8}{\sin\theta}$

$\frac{\sin 61}{7} = \frac{\sin\theta}{8}$

$\sin\theta = 88^\circ$ ✓

2

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

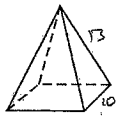
(i) Express the ratio of these areas in simplest form. [1]

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]

$400\,cm^3$ ✓ 1

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

$s = \sqrt{12^2 + 5^2}$

$= 13$

$100 + 2 \times 130 = SA$

$SA = 360\,cm^2$ ✓

3

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

1,080,000,000

1.08×10^9 ✓ 1

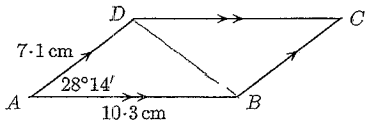
$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

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

$x = \frac{-(-5) \pm \sqrt{25+8}}{4}$

$= \frac{5 \pm \sqrt{33}}{4}$ ✓ 2

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



$A = bc \sin 28°14'$

$A = (7.1)(10.3) \sin 28°14'$

$A = 34.60 cm^2$ (2dec) ✓ 3

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

$x^2 + kx + 2x + 2k$

$x^2 + (2+k)x + 2k$

$k = 4$ $n = 6$

GO TO BACK 2

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

$\frac{\frac{7}{10}}{\frac{3}{10}}$

$\frac{7}{10} \times \frac{10}{3} = \frac{70}{30} = \frac{7}{3}$ ✓ 2

(i) Express with a rational denominator [2]

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

$= \frac{2\sqrt{5}+6}{5-9}$

$= \frac{2\sqrt{5}+6}{-4}$

$= \frac{2\sqrt{5}+8}{-4}$

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

$= -\frac{\sqrt{5}+3}{2}$ ✓ 2

End of Section C

Extra working page

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

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

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

$2k = 8$

$k = 4$

$k + 2 = n$

$n = 6$ ✓

$\therefore k = 4 \quad n = 6$

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10MaE	Mr McQuillan	
10MaF	Mr Gainford	

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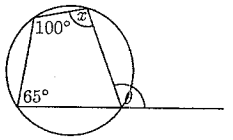
Section	Mark
D	20/20

Question 4 (20 marks) Answers

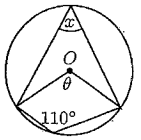
(a) Find the values of the pronumerals in each case. (Do NOT give reasons.) In each diagram O is the centre of the circle.

(i) 2



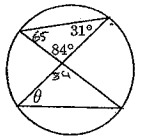
$x = 115°$ ✓
$\theta = 100°$ ✓

(ii) 2



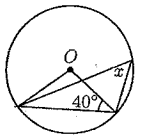
$x = 70°$ ✓✓
$\theta = 140°$ ✓

(iii) 2



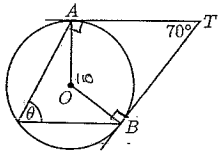
$\theta = 65°$ ✓

(iv) 2



$x = 50°$ ✓

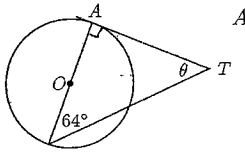
(v) 2



AT and BT are tangents.

$\theta = 55°$ ✓

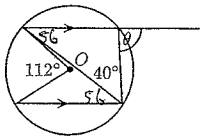
(vi) 2



AT is a tangent.

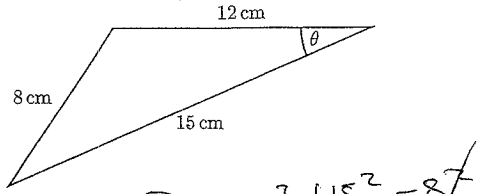
$\theta = 26°$ ✓

(vii) 2



$\theta = 96°$ ✓

(b) Use the Cosine rule to find the size of θ (correct to the nearest degree). [3]



$\cos\theta = \frac{12^2 + 15^2 - 8^2}{2(12)(15)}$

$\theta = 32^\circ$

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

ratio of sides 2:3
ratio of volumes 8:27

V of smaller = 72cm^3

End of Section D

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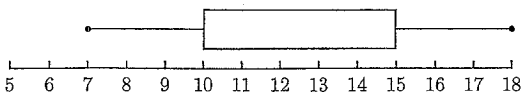
Section	Mark
E	17/20

Question 5 (20 marks) Answers

(a)



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

Find the:

(i) interquartile range, 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 75 70 65 60

B: 72 71 70 69 68

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

$A\ \bar{x} = 70$ ✓

$A\ s.d = 7.07$ (2dec)

$B\ \bar{x} = 70$

$B\ s.d = 1.41$ (2dec)

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

72 from B. 72 in B is more than 1 S.D. away from the mean whereas 75 in A is not even 1 S.D away from the mean.

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

(i) $\frac{x+4}{1-6x}$ $x \neq \frac{1}{6}$ ✓½ [1]

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

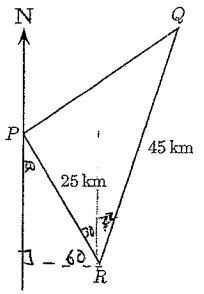
x must be negative

$x \leq \frac{1}{4}$ for the smallest case of $N=1$ ✓ (1)

$x \leq \frac{1}{4}N^2$

(9½)

(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]

$30 + 22 = 52°$ ✓

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

$PQ^2 = 25^2 + 45^2 - 2 \times 25 \times 45 \cos 52$

$PQ = 36$ km ✓

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

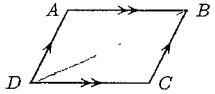
$A = \frac{1}{2}bh$ $A = \frac{1}{2}(6)(3)$

$b = 6$ $h = 3$ $= 9$ u² ✓

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

197 ✗

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



$\angle A = \frac{k}{\sin}$ $\angle B = 180 - \frac{k}{\sin}$ ✗ ½

$\sin B = -k$

Find $\sin B$.

(h) Simplify $\frac{m(m-c) - 3(c-m)}{m^2 - c^2}$. [1]

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

$\frac{m^2 - mc - 3c + 3m}{(m-c)(m+c)}$ $= \frac{(m-3)(c-m)}{m+c}$

GO TO BACK from back

End of Section E $= \frac{mc - m^2 - 3c + 3m}{m+c}$

$-c(m+3)$

(7½)

Extra working page

b) $\dfrac{m(m-c)-3(c-m)}{m^2-c^2}$

$= \dfrac{m(m-c)-3(c-m)}{(m-c)(m+c)}$

$= \dfrac{(m-3)(c-m)}{m+c}$

$= \dfrac{mc-m^2-3c+3m}{m+c}$

$= \dfrac{m^2-cm-3c+3m}{(m-c)(m+c)}$

$= \dfrac{-c(m+3)+m(m+3)}{(m-c)(m+c)}$

$= \dfrac{(m-c)(m+3)}{(m-c)(m+c)}$

$= \dfrac{m+3}{m+c}$ ✓

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Name: Student Sysito

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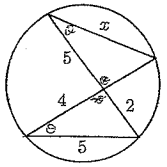
Section	Mark
F	13 /20

Question 6 (20 marks) Answers

(a) 

Find the value of x. [2]

Similar triangles

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

$x = 6\frac{1}{4}$

2

(b) (i) Expand and simplify $(x+y)^3$. [1]

$x^2 + 2xy + y^2 \ (x+y)$

$x^3 + 2x^2y + xy^2 + x^2y + 2xy^2 + y^3$

$x^3 + 3x^2y + 3xy^2 + y^3$

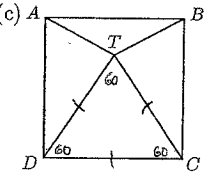
1

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

$x+y=1 \quad x^3+y^3=19$

$x^2+y^2=13$

2

(c) 

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

1. $\triangle$s ATD & BTC

$AD = BC$ (side of square)

$DT = CT$ (given $\triangle DTC$ is equilateral)

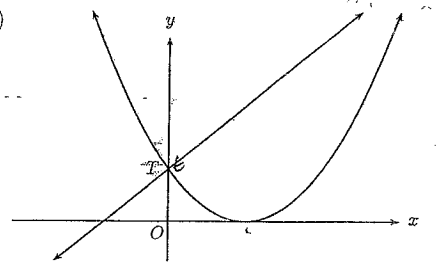
$\angle TDA = \angle TCB$ (since $\angle TDC = \angle TCD$, $90 - \angle TDC = 90 - \angle$

$\therefore \triangle ATD \equiv \triangle BTC$ (SAS)

$\therefore AT = BT$ (corresponding sides $\triangle ATD \equiv \triangle BTC$)

$\therefore \triangle ATB$ is isosceles ($AT = BT$)

$2\frac{1}{2}$

(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.

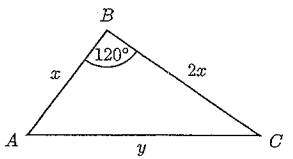
$t = \pm c^2$

$1\frac{1}{2}$

(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. [1]

$(12-r) + (t) =$ hours taken

1

(f) 

[3]

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

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

$y = \sqrt{-\frac{1}{2}x^2}$

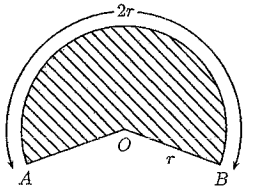
In the triangle ABC, find the exact value of $\frac{x}{y}$.

$\frac{x}{y} = \frac{x}{\sqrt{-\frac{1}{2}x^2}}$

$\frac{x}{y} = \frac{x}{-\frac{1}{2}x^2}$

$1\frac{1}{2}$

(g) The diagram shows a major sector of a circle with centre O and radius r. Find the area of the shaded region. [3]

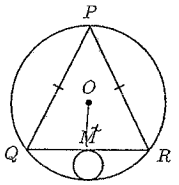


$\frac{\pi}{2\pi r} \times \pi r^2 = A$

$A = \frac{1}{2r} \times \pi r^2$

$A = \frac{\pi r^2}{2r}$

1

(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 $x^2 + y^2 = 36$. [1]

OQ is a radius $\therefore OQ = 6$

$OM^2 + QM^2 = OQ^2$

OM is x $\quad QM = y \quad \therefore x^2 + y^2 = 36$

(ii) Find the radius of the smaller circle. [2]

$x = 3 - \sqrt{13}$

$2r = 6 - x$

$r = 3.30$ (2 dec)

$\frac{1}{2}$

End of Section F