



SYDNEY BOYS HIGH
MOORE PARK, SURRY HILLS

2006
YEAR 10 YEARLY EXAMINATION

Advanced Mathematics

Directions to Candidates:

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Time allowed: 2 Hours

Examiner: Mr C. Kourtesis

Name: Stuart Sugito

Your Mathematics Class (Tick the box)	
10MaA Mr Fuller	<input type="checkbox"/>
10MaB Ms Ward	<input checked="" type="checkbox"/>
10MaC Mr Boros	<input type="checkbox"/>
10MaD Ms Evans	<input type="checkbox"/>
10MaE Mr McQuillan	<input type="checkbox"/>
10MaF Mr Gainford	<input type="checkbox"/>

Marker Use Only

Section	Mark
A	19 / 20

1085

Question 1 (20 marks)

Answers

Marks

(a) Simplify:

(i) $3k + 2 + k$

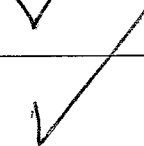
$4k + 2$



1

(ii) $\frac{3a}{8} + \frac{2a}{8}$

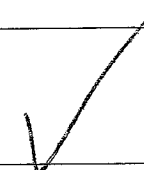
$\frac{5a}{8}$



1

(b) Find 8% of \$2700.

$\$216$



1

(c) Simplify:

(i) $\frac{\sqrt{130}}{\sqrt{5}}$

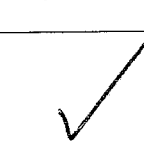
$\sqrt{26}$



1

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

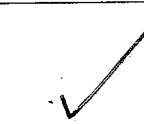
~~1 + 4m~~ $1 + 4m$



1

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

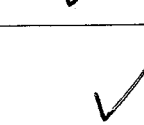
$a(b + 2a)$



1

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

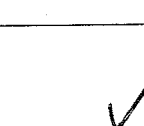
$4t = 1\frac{1}{2} \quad t = \frac{3}{8} = 0.375$



1

(f) Evaluate $\frac{\sqrt{22500}}{2.5 \times 6.4}$

$\frac{150}{16} = 9.375$



1

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

$\frac{a^{16}}{a^2} = a^{14}$



1

(h) Solve simultaneously

$y = 2$ and
 $y + 6 = 2x$
 $2 + 6 = 2x$
 $8 = 2x$
 $x = 4$



1

(i) Find $\tan 124^\circ 15'$ to one decimal place.

-1.5

1

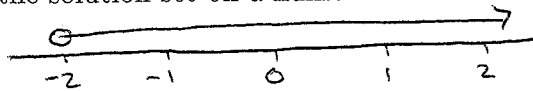
(j) (i) Solve $-2x + 1 > 5$.

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



1

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

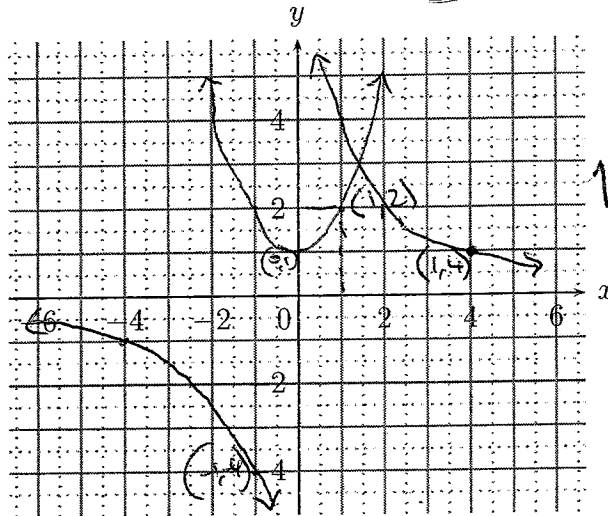


1

(k) Sketch the graphs of:

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

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



1

1

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

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

1

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

~~mx cents~~ mx cents

1

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

$2n^4$

1

(o) If $\sin \theta = 0.147$ and θ is acute, find θ to the nearest minute.

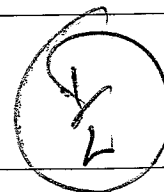
$8^\circ 27'$

1

(p) Solve $2m^2 = 18$.

$m^2 = 9$

$m = 3$



1

End of Section A



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Section	Mark
B	19½ / 20

Question 2 (20 marks)

Answers

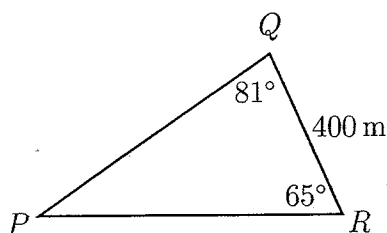
- (a) Theo invested \$8 000 for a period of four years to earn compound interest of 8% p.a. What is the amount of interest that Theo will earn?

$$A = 8000(1.08)^4 \quad I = \$2883.91$$

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

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

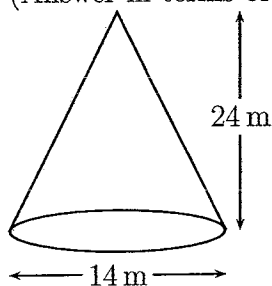
- (c)



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

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

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



$$SA = \pi r s$$

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

$$s = 25$$

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

$$SA = 175\pi$$

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

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

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

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

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

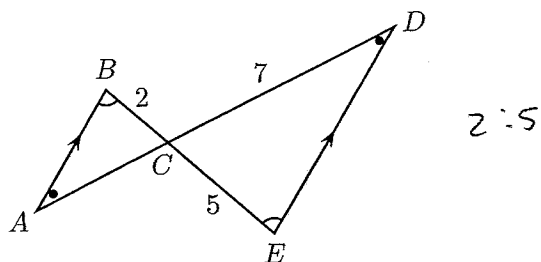
- (i) volume (in terms of π),

~~166~~
$$166 \frac{2}{3} \pi$$

- (ii) surface area (in terms of π).

$$100\pi$$

(g)



2
2

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

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

Find the

(i) coördinates of the centre, (4, -5)

1
2

1

(ii) radius. 10

1

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

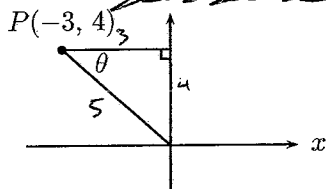
~~$A = n^2 + 8n + 16$~~

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

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

2
2

(j)

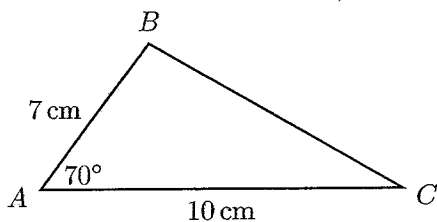


2
2

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

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

(k)



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

$= 101.12$ (2dec)

$BC = 10.06 \text{ cm}$

1
/

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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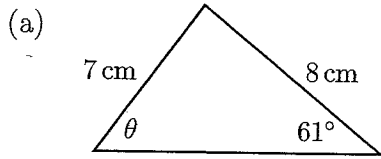
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Marker Use Only

Section	Mark
C	20/20

Question 3 (20 marks)

Answers



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

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

2

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

$$\sin \theta = 88^\circ$$

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

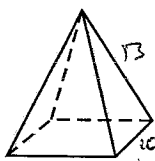
$$16:9$$

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

1

$$4:3$$

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



Find the:

(i) volume of the pyramid,

1

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

(ii) surface area of the pyramid.

3

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

$$= 13$$

$$100 + 2 \times 130 = SA$$

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

3

(d) Light travels at $3 \times 10^8 \text{ m/s}$. How many kilometres does light travel in one hour?

1

$$1,080,000,000$$

$$1.08 \times 10^9$$

1

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

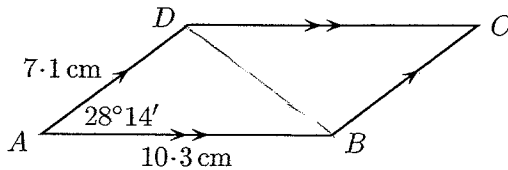
- (e) Use the quadratic formula to solve the equation $2x^2 - 5x - 1 = 0$ (answer in exact form).

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

$$= \frac{5 \pm \sqrt{33}}{4}$$

2

- (f) Find the area of the parallelogram $ABCD$.



$$A = bc \sin 28^\circ 14'$$

$$A = (7.1)(10.3) \sin 28^\circ 14'$$

$$A = 34.60 \text{ cm}^2 \text{ (2dec)}$$

3

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

$$\cancel{x^2 + kx + 2x + 2k}$$

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

$$\cancel{k=4} \quad n=6$$

GO TO
BACK

2

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

$$\frac{\frac{7}{10}}{\frac{3}{16}}$$

$$\frac{7}{10} \times \frac{16}{3} = \frac{70}{30} = \frac{7}{3}$$

2

- (i) Express with a rational denominator

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

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

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

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

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

2

End of Section C

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

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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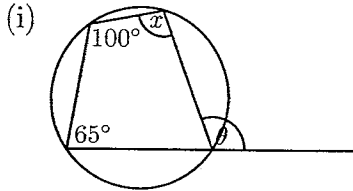
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Section	Mark
D	20/20

Question 4 (20 marks)

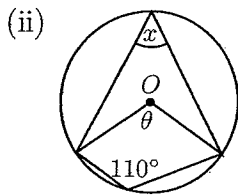
Answers

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



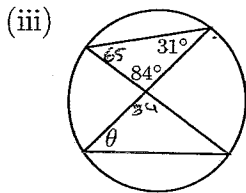
$x = 115^\circ$ ✓
 $\theta = 100^\circ$ ✓

2



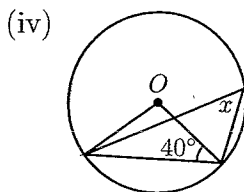
$x = 70^\circ$ ✓
 $\theta = 140^\circ$ ✓

2



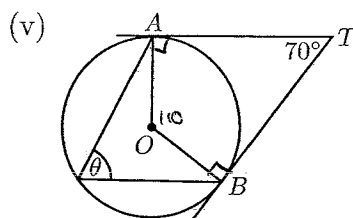
$\theta = 65^\circ$ ✓

2



$x = 50^\circ$ ✓

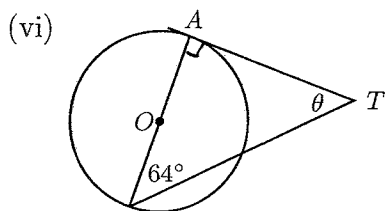
2



AT and BT are tangents.

$\theta = 55^\circ$ ✓

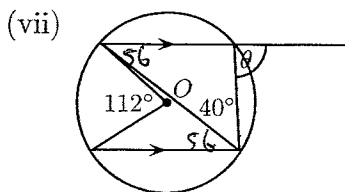
2



AT is a tangent.

$\theta = 26^\circ$ ✓

2

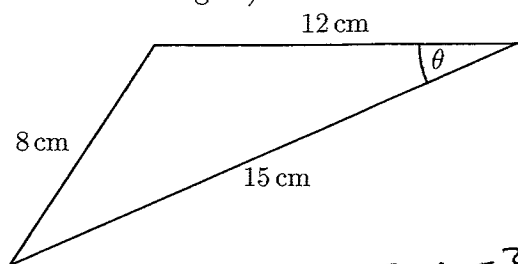


$\theta = 96^\circ$ ✓

2

- (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~~
~~volume of smaller = 72 cm³~~

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

volume of smaller = 72 cm^3

End of Section D



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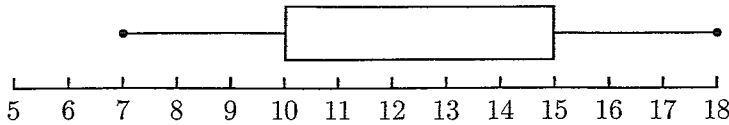
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Section	Mark
E	17/20

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~~ 70 ✓

A S.D. = ~~1.41~~ 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]

~~75 from A~~. 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) $\frac{x+4}{1-6x}$

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

$x \neq \frac{1}{6}$ [1]

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

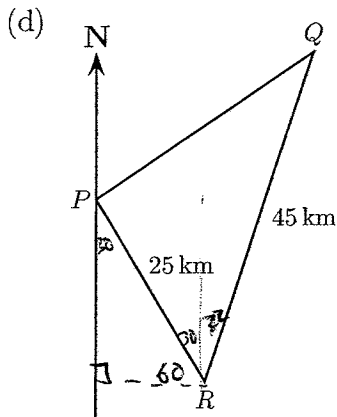
~~x must be negative~~

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

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

✓ [1]

9/2



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 $\angle PRQ$.

$$30 + 22 = \underline{52^\circ}$$

- (ii) Calculate the distance of town Q from town P to the nearest kilometre.

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

$$PQ = 36 \text{ km}$$

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

$$A = \frac{1}{2}bh$$

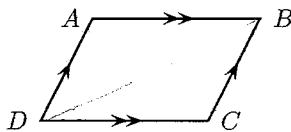
$$b = 6 \quad h = 3$$

$$A = \frac{1}{2} (6)(3) = 9 \text{ u}^2$$

- (f) Find the next term of the sequence 1, 9, 35, 91, ...

$$197$$

- (g) $ABCD$ is any parallelogram where $\sin A = k$.



Find $\sin B$.

$$\angle A = \frac{k}{\sin}$$

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

$$\sin B = -k$$

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

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

$$\begin{aligned} &= \frac{m(m-c) - 3(c-m)}{(m-c)(m+c)} \\ &= \frac{(m-3)(c-m)}{m+c} \end{aligned}$$

Go to BACK from back

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

7 1/2

Extra working page

$$\begin{aligned}
 & \text{h) } \frac{m(m-c) - 3(c-m)}{m^2 - c^2} \\
 & = \frac{m(m-c) - 3(c-m)}{(m-c)(m+c)} \\
 & = \frac{(m-3)(c-m)}{m+c} \\
 & = \frac{mc - m^2 - 3c + 3m}{m+c} \\
 & \neq \frac{m^2 - cm - 3c + 3m}{(m-c)(m+c)} \\
 & = \frac{-c(m+3) + m(m+3)}{(m-c)(m+c)} \\
 & = \frac{(m-c)(m+3)}{(m-c)(m+c)} \\
 & = \frac{m+3}{m+c} \checkmark
 \end{aligned}$$



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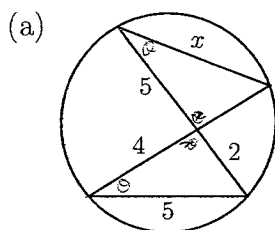
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Marker Use Only

Section	Mark
F	13 /20

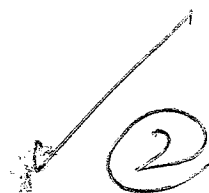
Question 6 (20 marks)

Answers



Find the value of x .
 Similar triangles
 $\frac{5}{4} = \frac{x}{5}$
 $x = 6\frac{1}{4}$

2



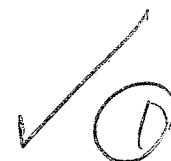
(b) (i) Expand and simplify $(x+y)^3$.

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

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

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

1

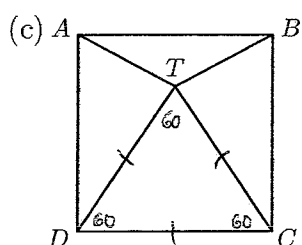


(ii) If $x+y=1$ and $x^3+y^3=19$, find the value of x^2+y^2 .

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

$$x^2+y^2=13$$

2

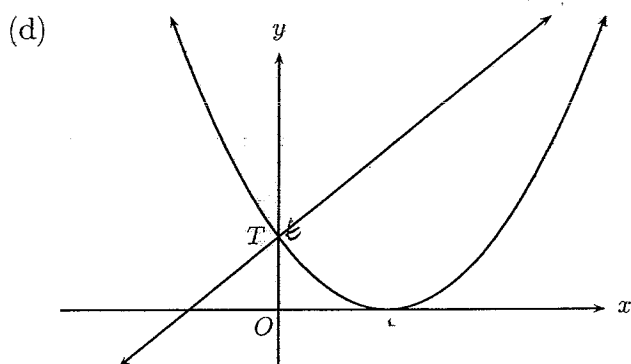


$ABCD$ is a square with point T inside the square such that $DT = CT = DC$. Prove that triangle ATB is isosceles.

1. ΔATD & BTC
 $AD = BC$ (side of square)
 $DT = CT$ (given $DT = CT = DC$)
 $\angle TDA = \angle TCB$ (Since $\angle TDC = \angle TCD$)
 $\therefore \angle ADO - \angle TDC = 90 - \angle TDC$
 $\therefore \Delta ATD \cong \Delta BTC$ (SAS)
 sides $\Delta ATD \cong \Delta BTC$
 $(AT = BT)$

3

$\therefore AT = BT$ (corresponding sides)
 $\therefore \Delta ATB$ is isosceles



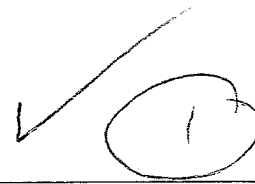
2

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 .

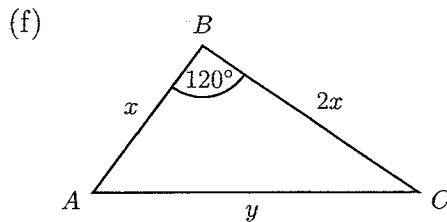
$$t = c^2$$

- (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.

$$(12-r) + t = \text{Hours taken}$$



1



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

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

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

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

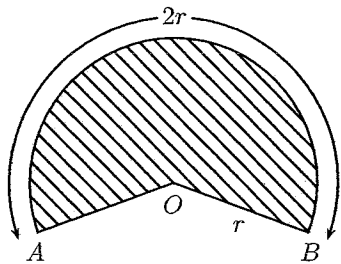
$$\frac{x}{y} = \frac{x}{\sqrt{-\frac{1}{2}x^2}}$$



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

3

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



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

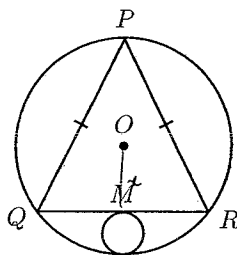
$$A = \frac{1}{2r} \times \pi r^2$$

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



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 $QR = 2y$.

OQ is a radius

- (i) Explain why $x^2 + y^2 = 36$. $\therefore OQ = 6$

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

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

1

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

$$x = 3 - \sqrt{5}$$

$$2r = 6 - x$$

$$r = 3 - 30 \text{ (dec)}$$



2

End of Section F