



KINCOPPAL – ROSE BAY  
SCHOOL OF THE SACRED HEART

2011  
Yearly Examination

## Year 10 5.3 Mathematics – Paper 1

### General Instructions

- Reading time – 5 minutes
- Working time – 50 minutes
- Write using black or blue pen
- Board-approved calculators may be used
- A formulae sheet is provided at the back of this paper
- All necessary working should be shown in every question

Note: Any time you have remaining should be spent revising your answers.

Total marks – 50

Pages 1 - 5

- Attempt all questions
- Start each question in a new writing booklet.
- Include any separate sheets with the relevant answer booklet.
- Write your student number on the front cover of each booklet to be handed in
- If you do not attempt a question, submit a blank booklet marked with your examination number and "N/A" on the front cover

Kincoppal-Rose Bay, School of the Sacred Heart  
10 5.3 Mathematics, Yearly Examination 2011

Paper 1: Total Marks 50  
Attempt all questions.

Answer each question in a separate booklet.

Question 1 (25 marks)	Start a New Booklet	Marks
(a) (i) Fully simplify $\frac{3h(7h-h)}{2h}$		2
(ii) Expand and simplify $x(2^0 - y)$		1
(iii) Evaluate $8^{\frac{2}{3}}$		2
(b) Expand and simplify:		
(i) $7(4-3a)-2(a+5)$		2
(ii) $(2x-8)(x+3)-5$		2
(c) Simplify $\frac{\sqrt{260}}{\sqrt{80}}$ . Leave your answer as a fully simplified surd.		2
(d) For the equation $x^2 + 6x - 12 = 0$		
(i) Solve the equation by using the 'completing the square' method.		3
(ii) Calculate the coordinates of the vertex of the parabola $y = x^2 + 6x - 12$ showing your working.		2
(iii) Hence, sketch the graph $y = x^2 + 6x - 12$ . You should indicate on your sketch all points of interest.		2

Question 1 continues on Page 2

Question 1 (continued)

Marks

(e) Use 'Trial and Error' to find one solution for the equation  $9x^2 + 3x - 1 = 7$ .  
You do not need to show working. Give your answer correct to 1 decimal place.

1

(f) Solve the following inequalities and show them on a number line:

(i)  $3x + 1 \geq 7$

1

(iii)  $\frac{3-x}{2} \leq 1$

2

(g) Using the formula  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ , find all solutions to the equation  
 $y = 3x^2 - 10x + 4$ . Write your answer as simplified surds.

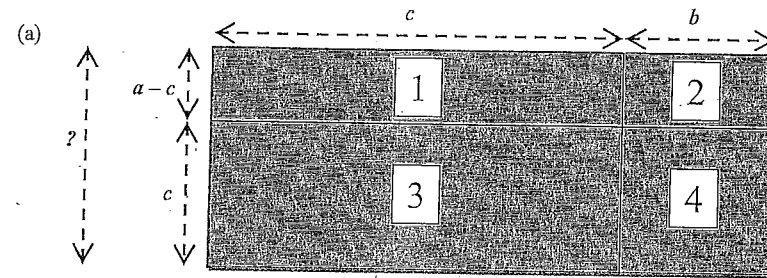
3

End of Question 1

Question 2 (25 marks)

Start a New Booklet

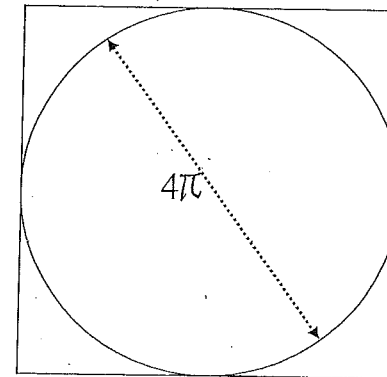
Marks



A large rectangle has been split into four smaller rectangles numbered 1, 2, 3 and 4 above. The dimensions of the smaller rectangles are indicated on the diagram.

- (i) State the missing dimension of the larger rectangle. 1
- (ii) In terms of  $a$ ,  $b$  and  $c$ , write an expression for the area of each smaller rectangle numbered 1 to 4. 2
- (iii) Use your answer to part (ii) to find the total area of the original rectangle and explain why it is equal to  $a(c+b)$ . 2

(b) A circle is drawn so that it touches the edges of a square as shown in the diagram: 4



The diameter of the circle is  $4\pi$ .

Mark says that the difference between the circumference of the circle and the perimeter of the square is  $\pi(16 - 4\pi)$ .

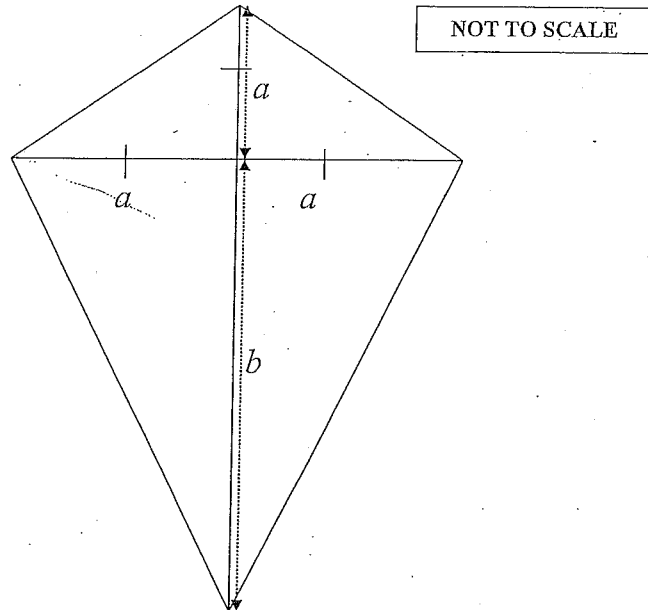
Using calculations, show whether or not you agree with Mark's statement. Leave all of your working in terms of  $\pi$ .

Question 2 continues on Page 4

Question 2 (continued)

Marks

(c) The kite below has 2 lengths represented by the variables  $a$  and  $b$ .



- (i) Calculate the area of the four smaller triangles. 2
- (ii) Show that sum of these areas is equivalent to the area of the kite when calculated using the formula  $A = \frac{1}{2}xy$ , where  $x$  and  $y$  are the diagonals of a kite. 2

(d) Consider the following pair of simultaneous equations:

$$\begin{aligned} x &= 1 - 3y \\ 2x + 5y &= 4 \end{aligned}$$

- (i) State whether it is more suitable to use the **elimination** or the **substitution** method to find the solution. 1
- (ii) Explain why you believe this way is more advantageous. 1
- (iii) Solve the pair of simultaneous equations showing all working in full. 2

Question 2 continues on Page 5

Question 2 (continued)

Start a New Booklet

Marks

(e) Simplify the following:

(i)  $\frac{a^3}{a^7}$  1

(ii)  $\sqrt{\frac{16a^2}{25b^2}}$  1

(iii)  $(3hk^2)^2 + 18kh$  2

(iii)  $\left(\frac{3d}{5}\right)^{-2}$  2

(f) Use your graphics calculator to sketch the graph of  $y = \frac{-1}{2-x}$ , indicating its important features 2

- End of Examination -



KINCOPPAL-ROSE BAY  
SCHOOL OF THE SACRED HEART

2011  
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## Year 10 5.3 Mathematics- Paper 2

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### Total marks – 50

#### Pages 1 - 8

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Total Marks 50  
Attempt Questions 1 – 5  
All questions are of equal value

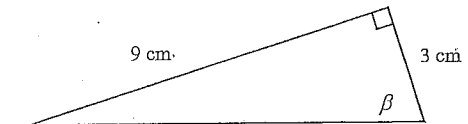
Answer each question starting a new page.

### Question 1 (10 marks)

- (a) The mining company BHP intends to dig a mine in the shape of a rectangular prism. Its dimensions are to be  $4 \text{ km} \times 3 \text{ km} \times 1 \text{ km}$ . Using the fact that  $1 \text{ km} = 1000 \text{ metres}$ , calculate the volume of earth that will need to be removed to make the mine. Give your answer in cubic metres, in scientific notation. 1

- (b) Calculate the exact distance from the point A with co-ordinates  $(5,3)$  to the point B at  $(-1, 1)$ . Write your answer as a simplified surd. 2

- (c) Calculate the size of the angle marked as  $\beta$ . Write your answer in degrees and minutes. 2



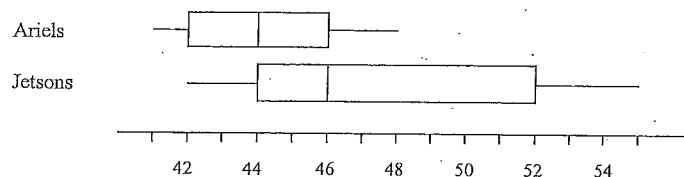
- (d) Expand and simplify  $(5 - 2\sqrt{2})(5 + 2\sqrt{2})$  2

- (e) Leonardo invests \$6840 in an account earning 6% p.a., with interest compounded quarterly. Calculate the interest earned in the first 5 years. 3

Question 2 (10 marks) START A NEW BOOKLET

(a) What is the size of each exterior angle of a regular nonagon?  
(An nonagon has nine sides). 1

(b) The two box-and-whisker plots below show the number of goals scored each game over a season by two Netball teams: the Ariels and the Jetsons.



- (i) Write down the inter-quartile range for the Jetsons' scores 1
- (ii) State one reason why the Ariels is the more consistent team. Justify your answer using statistics. 1

(c) The back-to-back stem-and-leaf plot below represents the heights (in cm) of the players in two sports teams: team A and team B. 3

Team A		Stem	Team B	
Leaf			Leaf	
	4	15		
7	7	16		
	5	17	5	
	0	18	0	0 4 9
		19	3	6 8
		20	2	4

- (i) Calculate the mean height of Team A.
- (ii) Write down the median height of team B.
- (iii) What fraction of players in team B are taller than all of the players in Team A?

(d) There are eighteen horses entered into Saturday's horse race. Jasmine says that the probability of the horse named Zipping winning the race must therefore be  $\frac{1}{18}$ . Is Jasmine's statement correct or incorrect? Justify your answer, giving a reason. 1

(e) A jar contains 12 spherical marbles: 3 are green, 2 are blue, one is red and the rest are yellow. Two marbles are randomly drawn from the jar, without replacement. 3

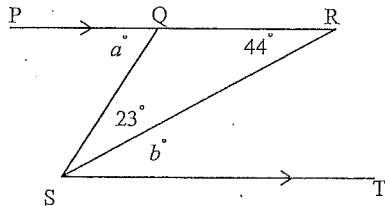
Calculate the probability that:

- (i) The first marble drawn is green
- (ii) The first marble is not yellow
- (iii) Both marbles are red

Question 3 (10 marks) START A NEW BOOKLET

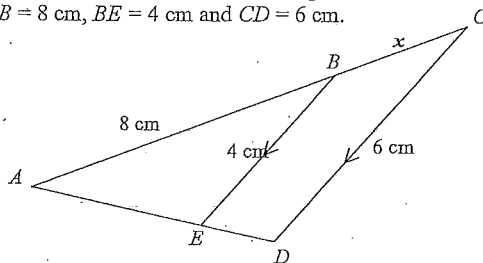
- (a) A rectangular courtyard has a total perimeter of 32 metres. Its length is 3 metres more than its width. Use algebra to calculate the area of the courtyard.  
[Hint: a diagram may help you]

- (b) This question relates to the diagram below:



- (i) Calculate the value of angle  $a$ , giving a reason for your answer  
(ii) Calculate the value of angle  $b$ , giving a reason for your answer

- (c) In the diagram below,  $BE$  is drawn parallel to  $CD$ .  
 $AB = 8$  cm,  $BE = 4$  cm and  $CD = 6$  cm.



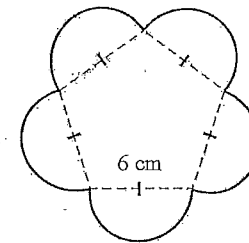
- (i) Prove that the two triangles  $ABE$  and  $ACD$  are similar.  
(ii) Hence, calculate the length of the interval  $BC$  (labelled  $x$ ).

Question 4 (10 marks) START A NEW BOOKLET

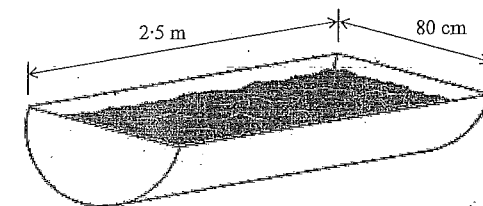
- (a) Rationalise the denominator of  $\frac{2+\sqrt{3}}{5-\sqrt{2}}$

- (b) Convert a speed of 3.6 kilometres per minute to metres per hour.

- (c) The shape below has semi-circles drawn on each side of a regular pentagon. Find the exact perimeter of this shape. Give your answer in terms of  $\pi$ .



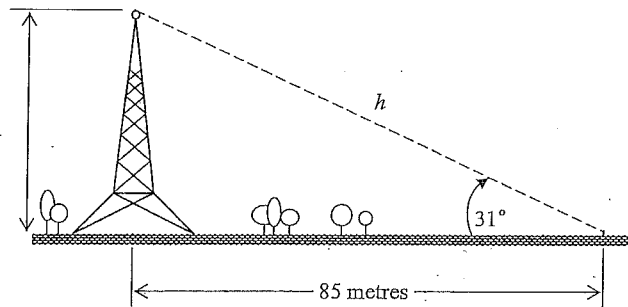
- (d) A trough used for providing water for cattle is in the shape of a half-cylinder. Its diameter is 0.8 metres and it is 2.5 metres long.



- (i) Calculate the volume of the half-cylinder (in cubic metres) (2 dp)  
(ii) Calculate the surface area of the inside of the trough. (2 dp)

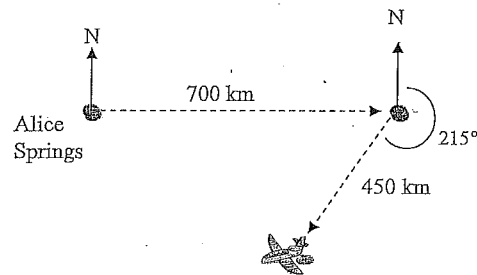
Question 5 (10 marks) START A NEW BOOKLET

- (a) (i) The equation of a straight line is given as  $2x - 3y + 5 = 0$ . Rewrite this equation in the format  $y = mx + b$  1
- (ii) Find the equation of the straight line which is perpendicular to the line  $2x - 3y + 5 = 0$  and which passes through the point  $(6, -3)$ . 3
- (b) An observer stands 85 metres away from the base of the centre of a tower. To view the top of the tower, she must incline her line of sight by  $31^\circ$ . 3



Find the distance  $h$ , from the observer to the top of the tower, correct to one decimal place.

- (c) A plane flies for 700 km due East from Alice Springs, and then for 450 km on a true bearing of  $215^\circ$ . 3



Calculate the shortest distance from the plane's current position to Alice Springs. Write your answer to the nearest kilometre.

END OF EXAM

YEAR 10 FINAL - KINGOOPAL 2011

SOLUTIONS Paper 1

Qu 1

(a) i)  $3h \times (6h) = 18h = 9h$

ii)  $x(1-y) = x - xy$

iii)  $(\sqrt{8})^2 = 2^2 = 4$

(b) i)  $28 - 21a - 2a - 10 = 18 - 23a$

ii)  $2x^2 - 2x - 24 - 5 = 2x^2 - 2x - 29$

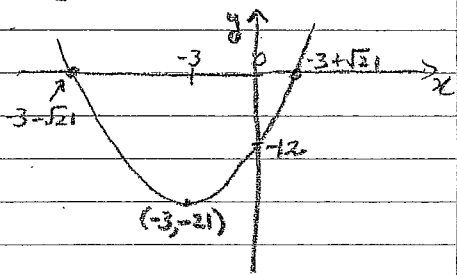
(c)  $\sqrt{\frac{26}{8}} = \sqrt{\frac{13}{4}} = \frac{\sqrt{13}}{2}$

(d) i)  $x^2 + 6x + 9 = 12 + 9$

$(x+3)^2 = 21$

$x = -3 \pm \sqrt{21}$

ii)  $y = (x+3)^2 - 21$   $V = (-3, -21)$



(e)  $x \approx 0.8$  or  $-1.1$

(f) (i)  $x \geq 2$

(ii)  $3 - x \leq 2$

$3 - 2 \leq x$

$1 \leq x$  or  $x \geq 1$

(a)  $x = \frac{10 \pm \sqrt{100 - 48}}{6} = \frac{10 \pm \sqrt{52}}{6}$

$\therefore x = \frac{10 \pm 2\sqrt{13}}{6} = \frac{5 \pm \sqrt{13}}{3}$

Qu 2

(a) i) c

ii)  $I = c(a-c)$   $III = c^2$

$II = b(a-c)$   $IV = bc$

(iii)  $A = c(a-c) + b(a-c) + c^2 + bc$   
 $= ca - c^2 + ba - bc + c^2 + bc$   
 $= ca + ba$   
 $= a(c+b)$

(b) radius of circle =  $2\pi$

$\therefore$  Perimeter =  $4\pi \times 4$

& Circumference =  $2\pi(2\pi)$

$\therefore$  Difference is  $16\pi - 4\pi^2$

$= \pi(16 - 4\pi)$

or  $4\pi(4 - \pi)$

So Mark is 'correct'

(c) i)  $A = \frac{1}{2}a^2 + \frac{1}{2}a^2 + \frac{1}{2}ab + \frac{1}{2}ab$

$= a^2 + ab = a(a+b)$

ii)  $A = \frac{1}{2}(a+b)(2a)$

$= (a+b) \cdot a$

SOLUTIONS PAPER 2

Qu 2 - cont

(d) i) Substitution

ii) "x" is already the subject of one equation.

iii)  $2(1-3y) + 5y = 4$

$2 - 6y + 5y = 4$

$y = -2$

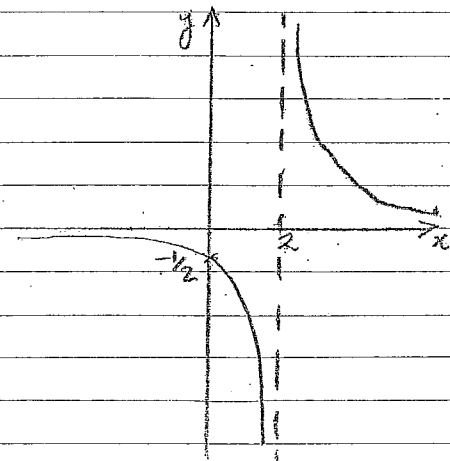
$x = 7$

(e) i)  $a^{-4} = \frac{1}{a^4}$

ii)  $= \frac{\sqrt{16a^2}}{\sqrt{25b^2}} = \frac{4a}{5b}$

iii)  $= \frac{9h^2k^4}{18kh} = \frac{hk^3}{2}$

(iv)  $= \left(\frac{5}{3d}\right)^2 = \frac{25}{9d^2}$



Quest 1

(a)  $V = 4000 \times 3000 \times 1000 \text{ m}^3$   
 $= 12 \times 10^9 \text{ m}^3 = 1.2 \times 10^{10} \text{ m}^3$

(b)  $AB = \sqrt{(5+1)^2 + (3-1)^2} = \sqrt{40} = 2\sqrt{10}$

(c)  $\tan \beta = 3 \rightarrow \beta = 71^\circ 34'$

(d)  $(5)^2 - (2\sqrt{2})^2 = 25 - 8 = 17$

(e)  $A = 6840(1 + \frac{0.06}{4})^{5 \times 4}$   
 $= 6840(1.015)^{20}$   
 $= \$9212.49$

$\Rightarrow I = 9212.49 - 6840 = \$2372.49$

Quest 2

(a)  $360 \div 9 = 40^\circ$

(b) (i)  $52 - 44 = 8$

(ii) Although the Jansons on average score more goals the Ariels' range and inter-quartile range (4) is much smaller.

(c) i)  $\bar{x} = 168.3$

(ii) Median =  $\frac{189 + 193}{2} = 191$

(iii)  $\frac{7}{10}$



SOLUTIONS PAPER 2 - cont.

Qu (2) - cont.

(d) Incorrect,  $P(E) = \frac{n(E)}{n(S)}$

requires each outcome to be "equally-likely", but clearly each horse has differing ability & hence different chance of winning.

(e) i)  $\frac{3}{12} = \frac{1}{4}$     ii)  $\frac{6}{12} = \frac{1}{2}$

iii) 0 as there is only 1 red.

Quest (3)



$P = x + (x+3) + x + (x+3)$

$\therefore 32 = 4x + 6 \rightarrow x = 6.5 \text{ m}$

$\therefore A = 6.5 \times 9.5 = 61.75 \text{ m}^2$

(b) i)  $a = 44 + 23 = 67^\circ$   
(Ext.  $\angle$  of  $\triangle QSR$ )

ii)  $b = 44^\circ$  (Alternate  $\angle$ 's)  
PR  $\parallel$  ST

(c) i)  $\angle BAE$  is common  
 $\angle ABE = \angle ACD$  (Corresp  $\angle$ 's  $BE \parallel CD$ )  
 $\therefore \triangle BAE \sim \triangle CAD$  (Equi-angular)

ii)  $\frac{x+8}{8} = \frac{6}{4}$  (ratios of corr. sides)  
 $x = 4$

Quest (4)

(a)  $\frac{2+\sqrt{3}}{5-\sqrt{2}} \times \frac{5-\sqrt{2}}{5-\sqrt{2}} = \frac{10-2\sqrt{3}+5\sqrt{3}-\sqrt{6}}{25-2}$   
 $= \frac{10-2\sqrt{2}+5\sqrt{3}-\sqrt{6}}{23}$

(b)  $3.6 \text{ km} = 1 \text{ min.}$   
 $3600 \text{ m} = 1 \text{ min.}$   
 $60 \times 3600 \text{ m} = 1 \text{ hr.}$   
 $\Rightarrow 216000 \text{ metres / hr.}$

(c)  $P = \pi r \times 5 = 15\pi \text{ cm.}$

(d)  $V = \frac{1}{2} \times \pi r^2 \times h$   
i)  $= \frac{1}{2} \times \pi \times (0.4)^2 \times 2.5 \text{ m}^3$   
 $= 0.63 \text{ m}^3$

ii)  $A = 2 \times (\frac{1}{2} \pi r^2) + \pi r \times h$   
 $= \pi (0.4)^2 + \pi (0.4)(2.5)$   
 $= 3.64 \text{ m}^2$

Quest (5)

(a) i)  $3y = 2x + 5 \rightarrow y = \frac{2x}{3} + \frac{5}{3}$

ii)  $m_1 = -\frac{3}{2}$  through  $(6, -3)$

$\therefore y + 3 = -\frac{3}{2}(x - 6)$

$\therefore 2y + 6 = -3x + 18$

$\therefore 3x + 2y - 12 = 0$

(b)  $\cos 31^\circ = \frac{85}{h}$

$h = \frac{85}{\cos 31^\circ} \approx 99.2 \text{ m}$

(c)  $575 \text{ km.}$