

St George Girls High School

Year 9

Yearly Examination

2005



# Mathematics

Time Allowed: 75 minutes

### Instructions

- Set out work clearly
  - Show all working where necessary
  - Calculators may be used
  - Diagrams are not to scale
- Section A – answers only
  - Section B – show all necessary working

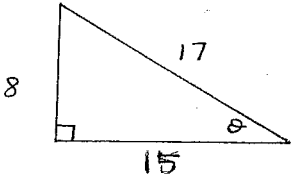

Section A	/15
Section B	
Question 1	/12
Question 2	/12
Question 3	/12
Question 4	/12
Question 5	/12
Question 6	/ 8
<b>Total</b>	<b>100</b>


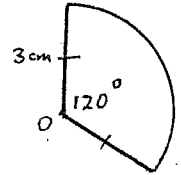
### Section A

(15 marks)

Write your answers to each question in the ANSWER column. You may do your working in the QUESTION column.

Question	Answer
1. Simplify $3a^2 \times -2a^3 + a^4$	
2. Express $2\frac{3}{4}\%$ as a simplified fraction.	
3. Evaluate $\left(\frac{9}{16}\right)^{\frac{-1}{2}}$ without the use of a calculator.	
4. Give a simplified expression for the area of this trapezium.	
5. What is the solution to this equation? $\frac{y-1}{5} = -3$	
6. What is the value of $y$ ?	

Question	Answer
7. What is the angle sum of a decagon? (ie. a 10-sided polygon).	
8. What is the value of $\tan \theta$ ? 	
9. What is the equation of the line passing through (0, 2), and parallel to $y = -3x - 1$ ?	
10. A dress has a marked price of \$125. It is offered for sale during a "15% off" discount sale. What is the new selling price?	
11. Give the abbreviation for the congruence test used to prove these triangles congruent. 	
12. Stephanie's normal hourly rate is \$10.50. How much does she earn, working $5\frac{1}{2}$ hours overtime, at time and a half? (round off to nearest cent)	

Question	Answer
13. Give an inequality, describing this section of the number line: 	
14. What is the perimeter of this shape? (giving your answer in terms of $\pi$ ) 	
15. Expand and simplify: $(2w - 3y)^2$	

Section B

Show all necessary working (unless stated otherwise)

Question 1 – Algebra and Rational Numbers – (12 marks)

Marks

a) If  $F(x) = 3 - 2x^2$ , find:

(i)  $F(-5)$

(ii)  $F(3p)$

1

1

b) Expand and simplify:  $-3x(2x-5) - (x-2)(5x+4)$

2

c) Factorise fully:

(i)  $28p^2q - 14p^2q^3 + 7pq^2$

(ii)  $9y(2-y) - (2-y)^2$

1

2

Section B – continued

Marks

d) Convert 110km/h into m/s

2

e) Round 0.0002053 off to 2 significant figures (write your answer in scientific notation).

1

f) Simplify  $9 \times 10^{-7} \times 6 \times 10^4 \times 2 \times 10^{-3}$

(again, writing your answer in scientific notation)

1

g) If a leaking pipe spills water at the rate of 12.6L/min, how much water is lost in 24 hours?

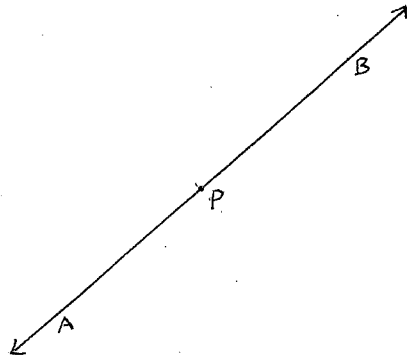
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Section B – continued

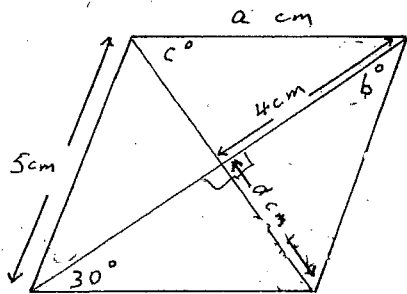
Question 2 – Measurement and Geometry – (12 marks)

Mark

- a) Construct a perpendicular to line  $AB$  from the point  $P$ . Leave all construction lines. 2



- b) This figure is a rhombus. Find the values of the pronumerals. 2



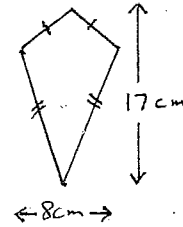
- $a =$   
 $b =$   
 $c =$   
 $d =$

Section B – continued

Marks

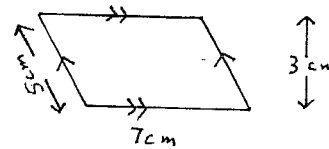
- c) Find the areas of these figures:

(i)



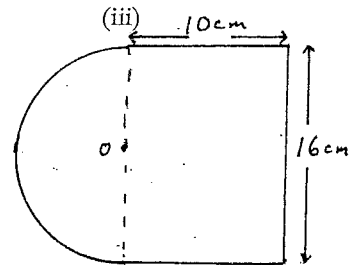
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(ii)



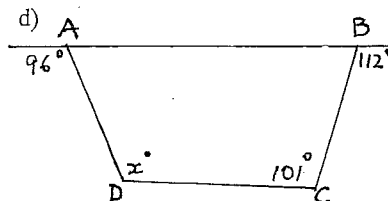
2

(iii)



3

(give answer to (iii) to 2 decimal places)



Find the value of  $x$  (giving full reasons):

2

Section B – continued

Question 3 – Equations and Consumer Arithmetic – (12 marks)

Mark

a) Solve these equations:

(i)  $\sqrt{a} = 2\frac{1}{2}$

(ii)  $3x^2 = 75$

(iii)  $2^{x-1} = 32$

1  
2  
2

b) If  $s = ut + \frac{1}{2}at^2$ , find  $u$  given that  $s = 10$ ,  $t = 2$ , and  $a = -5$

1

c) A filing cabinet depreciates at a rate of 10% p.a. It is originally worth \$250. How much is it worth after 3 years?

2

Section B – continued

Mark

d) Suzy earns \$146 000 p.a. (gross). She has allowable tax deductions of \$73, 500. She has paid \$23 700 in tax instalments throughout the financial year. Find:

(i) her taxable income.

1

(ii) her tax payable, using the tax table shown below:

2

Taxable income	Tax on this income
0–6000	Nil
6001–20 000	17¢ for each \$1 over \$6000
20 001–50 000	\$2380 plus 30¢ for each \$1 over \$20 000
50 001–60 000	\$11 380 plus 42¢ for each \$1 over \$50 000
60 000–	\$15 580 plus 47¢ for each \$1 over \$60 000

∴ Tax payable =

(iii) How much refund does she receive from the tax office? (Ignore the Medicare levy)

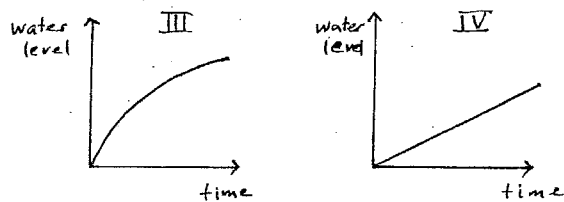
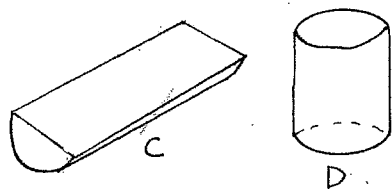
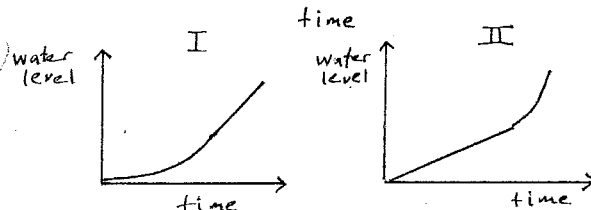
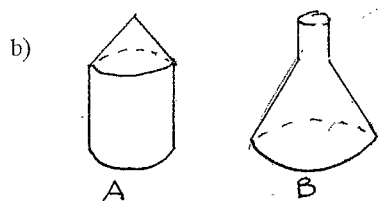
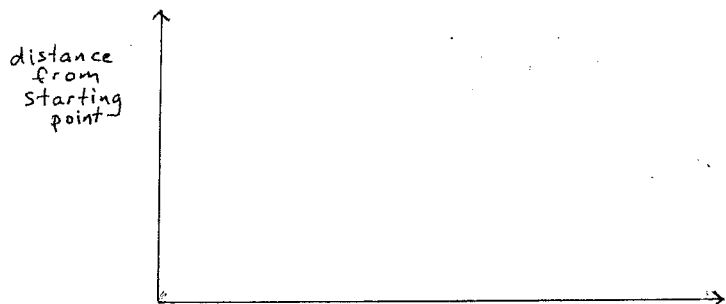
1

Section B – continued

Question 4 – Graphs and Coordinate Geometry – (12 marks)

Mark

- a) A girl walks up a hill at a constant rate. She rests for a few minutes, then runs back down the hill at a different constant rate to her starting point. Draw in a graph which could correspond to this trip. 2



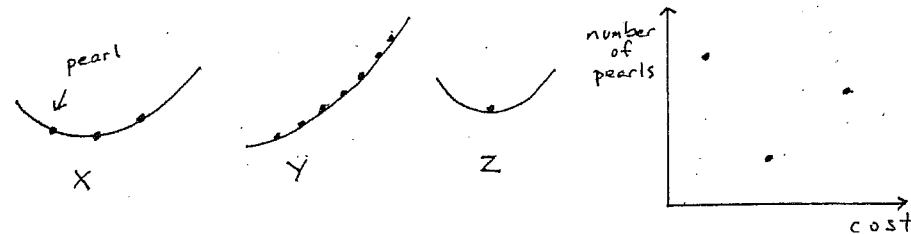
Each of the four containers pictured is filled with water at a steady rate. When the level of water in each container was plotted, the graphs I to IV were obtained. Match each container to its graph. 2

A \_\_\_\_\_ B \_\_\_\_\_ C \_\_\_\_\_ D \_\_\_\_\_

Section B – continued

Mark

- c) By using the scatter diagram on the right, determine which necklace costs the most. 1



X, Y, Z are three different pearl necklaces.

Answer \_\_\_\_\_ 1

- d) What is the equation of the x-axis? 1

- e) (i) By completing this table of values, graph the line  $x - 2y = 3$  on the number plane provided. 2

x	0	1	2
y			

- (ii) What is the gradient of this line? 1

Section B – continued

Mark

f) Given the two points  $A(-2, 3)$  and  $B(1, -4)$  find:

3

(i) the distance  $AB$  (exact value).

(ii) the gradient of the interval  $AB$ .

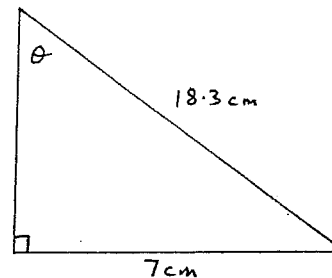
(iii) the mid-point of the interval  $AB$ .

Section B – continued

Question 5 – Trigonometry and Congruence – (12 marks)

Mark

a)



Find the size of the angle marked  $\theta$   
(to nearest degree)

2

b) A lady flies her plane 180km from Sydney airport at a bearing of  $153^\circ$  from true north.

(i) Draw a diagram representing this.

1

(ii) How far east of Sydney is she?

2

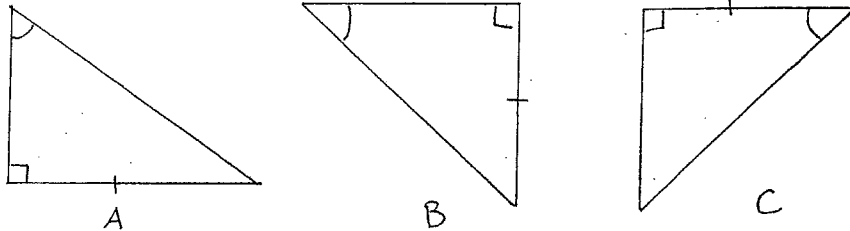
c) Write the direction  $NNW$  in terms of true bearings.

1

Section B – continued

Mark

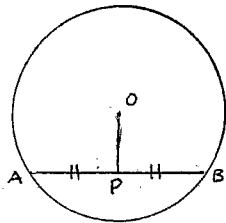
- d) Pick out which of these triangles are congruent, and give the congruence test used. 2



Answer: \_\_\_\_\_

Test: \_\_\_\_\_

e)



A line is drawn from the centre,  $O$ , of a circle, so that it bisects a chord  $AB$ . By drawing in two construction lines, and proving two triangles congruent, prove that  $OP$  is perpendicular to  $AB$ .

Give full reasons at each step.

4

Section B – continued

Question 6 – Spreadsheets – (8 marks)

1. In the spreadsheet below what name is given to the cell with \*\* in it?

	A	B
1		
2		
3		**
4		

2. Consider the spreadsheet below.

	A	B	C	D
1	6	8	14	48
2	7	6		42
3	8	7		56
4	9	3		27

- a) The number in cell C1 is the sum of the numbers in cells A1 and B1. Write two different formulae which could appear in cell C1 to achieve this.
- or \_\_\_\_\_
- b) Cell C1 was then highlighted and the cursor was dragged down to cell C4 and the command FILL DOWN was used. Write the number which would then appear in cell C4.
- \_\_\_\_\_
- c) Carefully study columns A, B and D. Write the formula which would appear in cell D3.
- \_\_\_\_\_



**Section B – continued**

3. Consider the spreadsheet below.

	A	B
1	2	
2	4	
3	9	

Column B is to list the squares of the number in Column A. Write a formula which could appear in cell B3.

\_\_\_\_\_

4. Consider the spreadsheet below.

	A	B	C
1	6		
2	7		
3	8		
4		1	
5		2	

a) The formula  $=\$A\$1*B4$  was entered in cell C4. Write the number which would then appear in cell C4.

\_\_\_\_\_

b) If cell C4 was then highlighted, the cursor dragged down to cell C5 and the command FILL DOWN used, write the number which would appear in cell C5.

\_\_\_\_\_

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100%  
Congratulations!!

# Mathematics

Time Allowed: 75 minutes

### Instructions

- Set out work clearly
- Show all working where necessary
- Calculators may be used
- Diagrams are not to scale

- Section A - answers only
- Section B - show all necessary working

Section A	15 / 15
Section B	
Question 1	12 / 12
Question 2	13 / 13
Question 3	12 / 12
Question 4	12 / 12
Question 5	12 / 12
Question 6	8 / 8
Total	84 / 88

100%

### Section A

(15 marks)

Write your answers to each question in the ANSWER column. You may do your working in the QUESTION column.

Question	Answer
1. Simplify $(3a^2 \times -2a^3) + a^4 - ba^5 + a^4$	$-ba^5 + a^4$ ✓
2. Express $2\frac{3}{4}\%$ as a simplified fraction. $\frac{11}{4} \div 100 = \frac{11}{4} \times \frac{1}{100}$	$\frac{11}{400}$ ✓
3. Evaluate $(\frac{9}{16})^{\frac{1}{2}}$ without the use of a calculator. $\frac{16}{4} \cdot \frac{9}{3}$	$\frac{4}{3}$ ✓
4. Give a simplified expression for the area of this trapezium. $A = \frac{1}{2}h(a+b)$ $= \frac{1}{2} \cdot 2b(3a+b+7a-3b)$ $= b(10a-2b)$ $= 10ab - 2b^2$	$10ab - 2b^2$ ✓
5. What is the solution to this equation? $\frac{y-1}{5} = -3$ $y-1 = -15$ $y = -14$	$y = -14$ ✓
6. What is the value of y? $100 + 90 + 5y = 360$ $A = \frac{1}{2}h(a+b)$	$y = 34$ ✓



Section B

Show all necessary working (unless stated otherwise)

Question 1 - Algebra and Rational Numbers - (12 marks)

Marks

a) If  $F(x) = 3 - 2x^2$ , find:

(i)  $F(-5)$

$$\begin{aligned} F(-5) &= 3 - [2(-5)^2] \\ &= 3 - 2(25) \\ &= 3 - 50 \\ &= -47 \end{aligned}$$

$$\begin{aligned} F(-5) &= 3 - [2 \times (-5)^2] \\ &= 3 - [2 \times 25] \\ &= 3 - 50 = -47 \end{aligned}$$

(ii)  $F(3p)$

$$\begin{aligned} F(3p) &= 3 - [2(3p)^2] \\ &= 3 - [2(9p^2)] \\ &= 3 - 18p^2 \end{aligned}$$

$$\begin{aligned} F(3p) &= 3 - [2(3p)^2] \\ &= 3 - [2(9p^2)] \\ &= 3 - 18p^2 \end{aligned}$$

b) Expand and simplify:  $-3x(2x-5) - (x-2)(5x+4)$

$$\begin{aligned} -6x^2 + 15x - [5x^2 + 4x - 10x - 8] \\ = -6x^2 + 15x - 5x^2 - 4x + 10x + 8 \\ = -11x^2 + 21x + 8 \end{aligned}$$

$$\begin{aligned} 18y - 9y^2 - (4 - 4y + y^2) \\ = 18y - 9y^2 - 4 + 4y - y^2 \\ = 22y - 4 - 10y^2 \end{aligned}$$

c) Factorise fully:

(i)  $28p^2q - 14p^2q^3 + 7pq^2$

$$7pq(4p - 2pq^2 + q)$$

(ii)  $9y(2-y) - (2-y)^2$

$$9y(2-y) - (2-y)(2-y)$$

$$\begin{aligned} (9y - 2 + y)(2-y) \\ = (8y - 2)(2-y) \end{aligned}$$

1  
2

Section B - continued

Marks

d) Convert 110km/h into m/s

$$\begin{aligned} 110 \times 1000 \div 60 \div 60 \text{ m/s} \\ = 30.555... \\ \approx 30.56 \text{ m/s (2dp)} \end{aligned}$$

e) Round 0.0002053 off to 2 significant figures (write your answer in scientific notation).

$$\begin{aligned} 0.00021 \\ = 2.1 \times 10^{-4} \end{aligned}$$

f) Simplify  $9 \times 10^{-7} \times 6 \times 10^4 \times 2 \times 10^{-3}$

(again, writing your answer in scientific notation)

$$\begin{aligned} = 0.000108 \\ = 1.08 \times 10^{-4} \end{aligned}$$

g) If a leaking pipe spills water at the rate of 12.6L/min, how much water is lost in 24 hours?

$$\begin{aligned} 12.6 \times 60 \times 24 \text{ L/s (in 24 hrs)} \\ = 18144 \text{ L/s} \end{aligned}$$

$\therefore$  18 144 Litres is lost in 24 hours.

$\frac{5}{5}$

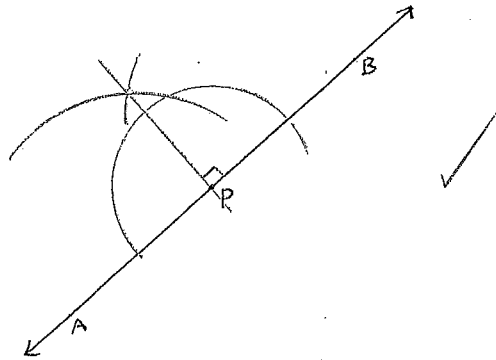
Section B - continued

Question 2 - Measurement and Geometry - (12 marks)

Marks

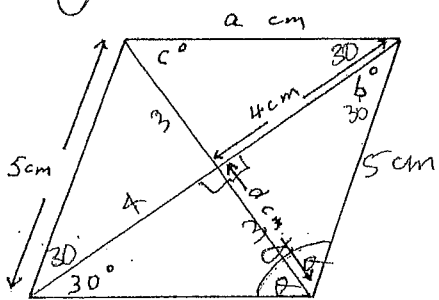
a) Construct a perpendicular to line AB from the point P. Leave all construction lines.

2



b) This figure is a rhombus. Find the values of the pronumerals.

2



$a = 5 \text{ cm}$  (equal sides of rhombus)  
 $b = 30^\circ$  (const min)  $30^\circ$   
 $c = 60^\circ$  (const min)  $60^\circ$   
 $d = 3$

$\tan \theta = \frac{4}{3}$

$\theta = 53^\circ 7' 48''$

~~$53^\circ 8'$  (const min)~~

$\alpha = 2\theta$

$= 2 \times 53^\circ 7' 48''$

$= 106^\circ 15' 36''$

Question impossible

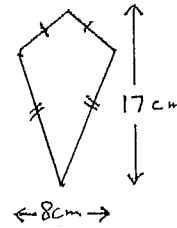
(4)

Section B - continued

Mark

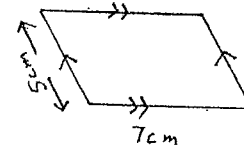
c) Find the areas of these figures:

(i)



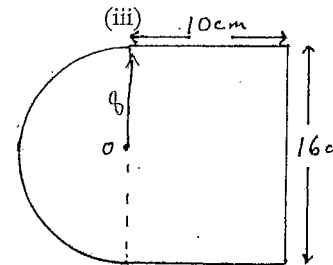
$A = \frac{1}{2}xy$   
 $= \frac{1}{2}17 \times 8$   
 $\therefore \text{Area} = 68 \text{ cm}^2$  ✓

(ii)



$A = bh$   
 $= 7 \times 3$   
 $\therefore \text{Area} = 21 \text{ cm}^2$  ✓

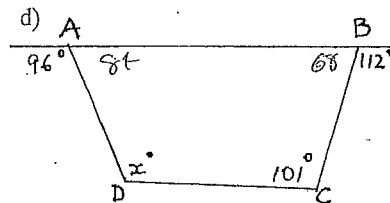
(iii)



(give answer to (iii) to 2 decimal places)

$A = U_0 + \frac{\pi r^2}{2}$   
 $= (10 \times 16) + \frac{64\pi}{2}$   
 $= 160 + 32\pi$   
 $= 260.530 \dots$   
 $\therefore \text{Area} \approx 260.53 \text{ (2 dp) cm}^2$  ✓

$160 + \frac{64\pi}{2}$   
 $= 160 + 32\pi$   
 $= 260.536 \dots$



Find the value of x (giving full reasons):

$x = 360 - (\hat{D}AB + \hat{A}BC + 101)$   
 (sum of quad is 360)

$\hat{D}AB = 180 - 96$  (str L = 180)  
 $= 84^\circ$

$\hat{A}BC = 180 - 112$  (str L = 180)  
 $= 68^\circ$

$\therefore x = 360 - (84 + 68 + 101)$  (all as stated above)

(9)

Section B - continued

Question 3 - Equations and Consumer Arithmetic - (12 marks)

Marks

a) Solve these equations:

(i)  $(\sqrt{a})^2 = (2\frac{1}{2})^2$

$a = 6.25$  ✓

(ii)  $3x^2 = 75$

$x^2 = 25$

$\therefore x = \pm 5$  ✓

(iii)  $2^{x-1} = 32$

$2^{x-1} = 2^5$

$x-1 = 5$   
 $\therefore x = 6$  ✓

1  
2  
2

b) If  $s = ut + \frac{1}{2}at^2$ , find  $u$  given that  $s=10$ ,  $t=2$ , and  $a=-5$

1

$10 = 2u + (\frac{1}{2} \times -5 \times 2^2)$

$10 = 2u + (-5 \times 2)$

$10 = 2u - 10$

$20 = 2u$

$\therefore u = 10$  ✓

$10 = 2u + (\frac{1}{2} \times -5 \times 4)$

$10 = 2u - 10$

$20 = 2u$

$u = 10$

c) A filing cabinet depreciates at a rate of 10% p.a. It is originally worth \$250. How much is it worth after 3 years?

2

$A = P(1-R)^n$

$= 250(1-0.1)^3$

$= 250 \times 0.729$

$= \$182.25$  ✓

$\frac{8}{8}$

↳ After 3 years the cabinet is worth \$182.25

Section B - continued

Marks

d) Suzy earns \$146 000 p.a. (gross). She has allowable tax deductions of \$73, 500. She has paid \$23 700 in tax instalments throughout the financial year. Find:

(i) her taxable income.

taxable income =  $146\ 000 - 73\ 500$   
 $= \$72\ 500$  ✓

(ii) her tax payable, using the tax table shown below:

Taxable income	Tax on this income
0-6000	Nil
6001-20 000	17¢ for each \$1 over \$6000
20 001-50 000	\$2380 plus 30¢ for each \$1 over \$20 000
50 001-60 000	\$11 380 plus 42¢ for each \$1 over \$50 000
60 000-	\$15 580 plus 47¢ for each \$1 over \$60 000

tax payable =  $(72\ 500 - 60\ 000)0.47$   
 $= 15\ 580$   
 $= \$21\ 455$

$\therefore$  Tax payable = \$21 455 ✓

(iii) How much refund does she receive from the tax office? (Ignore the Medicare Levy)

Refund =  $23\ 700 - 21\ 455$   
 $= \$2\ 245$  ✓

↳ She will receive \$2 245 as a refund from the tax office

$\frac{4}{4}$

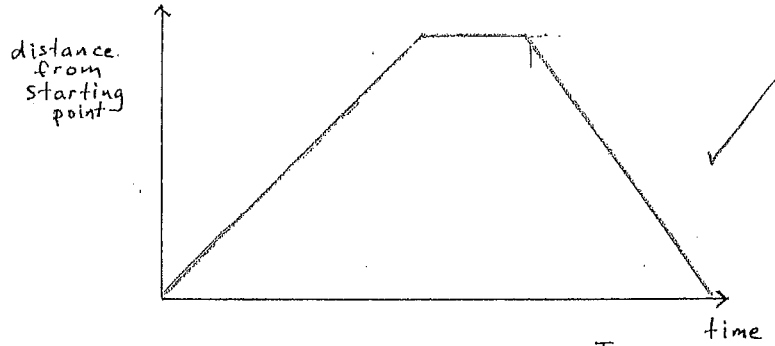
Section B – continued

Question 4 – Graphs and Coordinate Geometry – (12 marks)

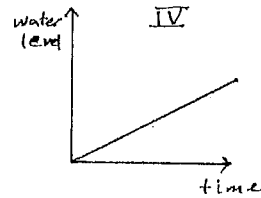
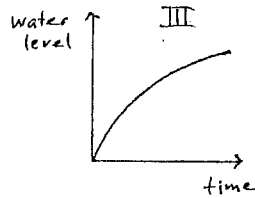
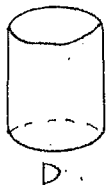
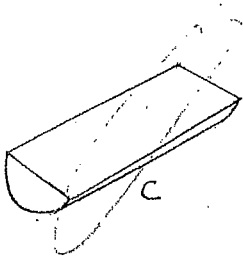
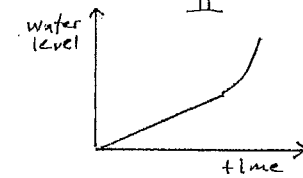
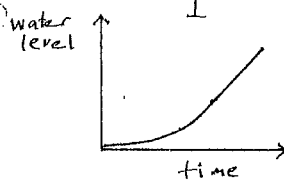
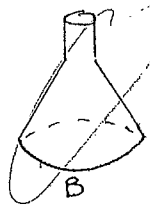
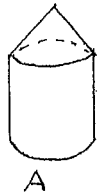
Marks

- a) A girl walks up a hill at a constant rate. She rests for a few minutes, then runs back down the hill (at a different constant rate) to her starting point. Draw in a graph which could correspond to this trip.

2



b)



Each of the four containers pictured is filled with water at a steady rate. When the level of water in each container was plotted, the graphs I to IV were obtained. Match each container to its graph.

2

A II

B I

C III

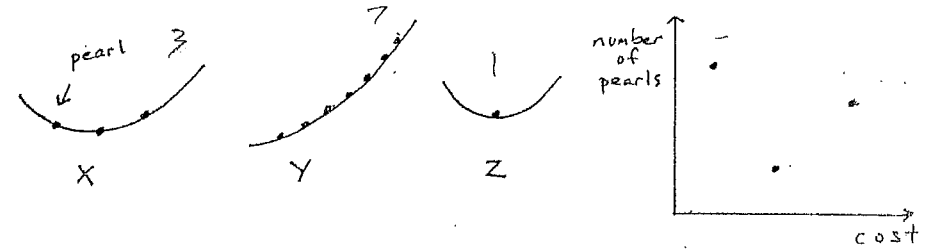
D IV

(4)

Section B – continued

Ma

- c) By using the scatter diagram on the right, determine which necklace costs the most.



X, Y, Z are three different pearl necklaces.

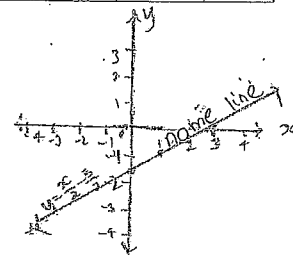
Answer X cost the most

- d) What is the equation of the x-axis?

$y = 0$

- e) (i) By completing this table of values, graph the line  $x - 2y = 3$  on the number plane provided. - none provided

x	0	1	2
y	-1.5	-1	-0.5



- (ii) What is the gradient of this line?

gradient =  $\frac{1}{2}$

$$\begin{aligned}
 x - 2y &= 3 - x \\
 y &= -1.5 + \frac{1}{2}x \\
 &= \frac{1}{2}x - 1.5 \\
 x - 2y &= 3 \\
 -2y &= 3 - x \\
 y &= -\frac{3}{2} + \frac{x}{2} \\
 y &= \frac{x}{2} - \frac{3}{2}
 \end{aligned}$$

~~$x - 3 = 2y$~~

$x = 3 + 2y$

$x - 3 = 2y$

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

$\frac{x}{2} = \frac{x}{2} + \frac{3}{2}$

Section B - continued

f) Given the two points  $A(-2, 3)$  and  $B(1, -4)$  find:  $x_1 - x_2$   
 $(-2) - (1)$   
 $-3$   
 $(1) - (-2)$   
 $3$  Marks  
3

(i) the distance  $AB$  (exact value).

$$d = \sqrt{(-2-1)^2 + (3-(-4))^2}$$

$$= \sqrt{(-3)^2 + (7)^2}$$

$$= \sqrt{9 + 49}$$

$$= \sqrt{58}$$

(ii) the gradient of the interval  $AB$ .

$$\text{gradient} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{-4 - 3}{1 - (-2)}$$

$$= \frac{-7}{3}$$

(iii) the mid-point of the interval  $AB$ .

$$\text{midpoint} = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$= \left( \frac{-2 + 1}{2}, \frac{3 + (-4)}{2} \right)$$

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

~~$(-0.5, -0.5)$~~

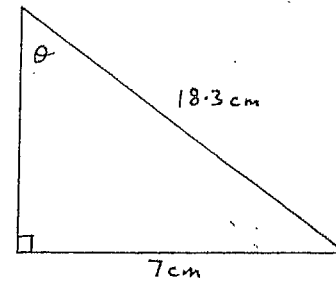
3

Section B - continued

Question 5 - Trigonometry and Congruence - (12 marks)

Marks

a)



Find the size of the angle marked  $\theta$   
(to nearest degree)

$$\sin \theta = \frac{7}{18.3}$$

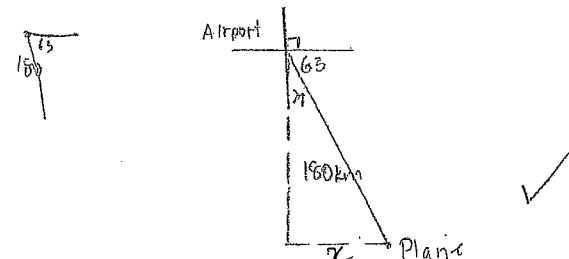
$$\theta = \sin^{-1} \frac{7}{18.3}$$

$$= 22.4 \dots$$

$$\hat{=} 22^\circ \text{ (c not dec)}$$

b) A lady flies her plane 180km from Sydney airport at a bearing of  $153^\circ$  from true north.

(i) Draw a diagram representing this.



(ii) How far east of Sydney is she?

$$\sin 27 = \frac{x}{180}$$

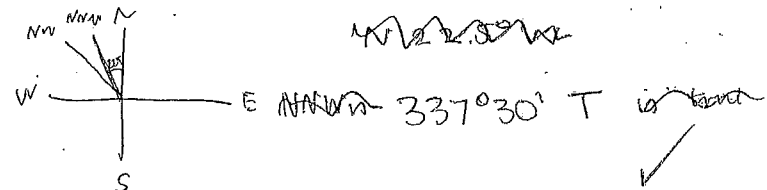
$$x = 180 \sin 27$$

$$= 81.718 \dots$$

$$\hat{=} 81.72 \text{ (c not 2dp) km}$$

$\therefore$  She is 81.72 km 'east' of Sydney.

c) Write the direction  $NW$  in terms of true bearings.



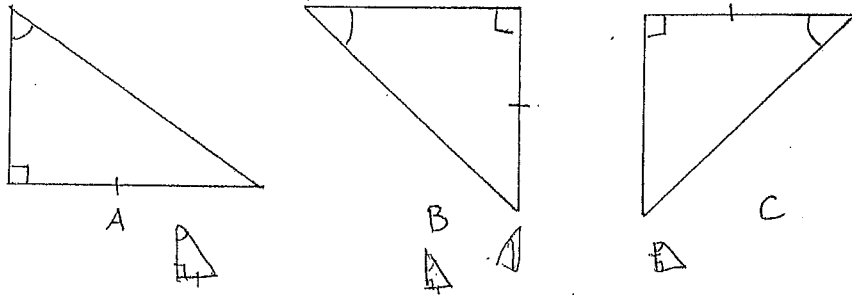
6



Section B - continued

Marks

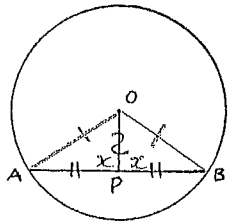
- d) Pick out which of these triangles are congruent, and give the congruence test used. 2



Answer: A A, B B

Test: AAS

e)



A line is drawn from the centre,  $O$ , of a circle, so that it bisects a chord  $AB$ . By drawing in two construction lines, and proving two triangles congruent, prove that  $OP$  is perpendicular to  $AB$ .

Give full reasons at each step.

4

In  $\Delta$ 's  $AOP$  and  $BOP$

1.  $AO = BO$  (equal radii of circle)

2.  $AP = BP$  (given i.e.  $PO$  bisects  $AB$ )

3.  $OP$  (common)  
 $\Delta AOP \cong \Delta BOP$  (SSS)

$\therefore \hat{A}PO = \hat{B}PO$  (corresp  $\angle$ 's, cong  $\Delta$ 's)

Let  $\hat{A}PO$  be  $x$   
Let  $\hat{B}PO$  be  $x$

$\therefore 2x = 180^\circ$  (str  $\angle$  is  $180^\circ$ )

$\therefore x = 90^\circ$

$\therefore OP$  is perpendicular to  $AB$



Section B - continued

Question 6 - Spreadsheets - (8 marks)

1. In the spreadsheet below what name is given to the cell with  $**$  in it?

	A	B
1		
2		
3		**
4		

B3 ✓

2. Consider the spreadsheet below.

	A	B	C	D
1	6	8	14	48
2	7	6		42
3	8	7		56
4	9	3		27

- a) The number in cell C1 is the sum of the numbers in cells A1 and B1. Write two different formulae which could appear in cell C1 to achieve this.

~~=SUM(A1:B1)~~ ✓ or ~~=A1+B1~~ ✓  
=SUM(A1:B1) ✓

- b) Cell C1 was then highlighted and the cursor was dragged down to cell C4 and the command FILL DOWN was used. Write the number which would then appear in cell C4.

12 ✓

- c) Carefully study columns A, B and D. Write the formula which would appear in cell D3.

= A3 \* B3 ✓

Section B – continued

3. Consider the spreadsheet below.

	A	B
1	2	
2	4	
3	9	

Column B is to list the squares of the number in Column A. Write a formula which could appear in cell B3.

$= A3^2$  ✓  ~~$= A3 * A3$~~

4. Consider the spreadsheet below.

	A	B	C
1	6		
2	7		
3	8		
4		1	
5		2	

a) The formula  $=A\$1*B4$  was entered in cell C4. Write the number which would then appear in cell C4.

6 ✓

b) If cell C4 was then highlighted, the cursor dragged down to cell C5 and the command FILL DOWN used, write the number which would appear in cell C5.

12 ✓

8/8