



KINCOPPAL – ROSÉ BAY
SCHOOL OF THE SACRED HEART

2017
SEMESTER 1
EXAMINATION

Date: 23rd May, 2017

MATHEMATICS
YEAR 10
STAGE 5.3

STUDENT NAME :

TEACHER :

Instructions:

- Time allowed 1 hour 30 minutes.
- All necessary working must be shown.
- Marks may be deducted for untidy or careless work
- Answer Part A on the Multiple Choice Answer Sheet provided
- Answer Parts B on this paper.
- Calculators should be used

Results

Section I : Multiple Choice	/15
Section II	
Part A: Indices	/11
Part B: Surds	/12
Part C: Non-Right Trigonometry	/16
Part D: Bivariate Data	/6
Part E: Quadratic Equations	/20
Total:	/80



KINCOPPAL – ROSE BAY
SCHOOL OF THE SACRED HEART

2017

Semester 1 Examination

Year 10 Stage 5.3
Section 1 – Multiple Choice

Student Name:

Instructions for answering questions

Complete your answers using blue or black pen.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
A B C D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word correct and drawing an arrow as follows.

A B C D
correct

Section I: Multiple Choice (15 marks)

Shade the correct answer on the sheet provided.

Allow 20 minutes for this section

- | | |
|---|--|
| 1. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> | 9. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> |
| 2. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> | 10. A <input type="radio"/> B <input type="radio"/> C <input checked="" type="radio"/> D <input type="radio"/> |
| 3. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> | 11. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> |
| 4. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> | 12. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> |
| 5. A <input type="radio"/> B <input type="radio"/> C <input checked="" type="radio"/> D <input type="radio"/> | 13. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> |
| 6. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input checked="" type="radio"/> | 14. A <input type="radio"/> B <input checked="" type="radio"/> C <input type="radio"/> D <input type="radio"/> |
| 7. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> | 15. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> |
| 8. A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> | |

1. Which of the following expressions is NOT equal to a^3 ?

- A. $(a^6)^{\frac{1}{2}}$ B. $\frac{1}{(a^{-1})^{-3}}$ C. $\frac{a^2 \times a^5}{a^4}$ D. $\frac{a}{a^{-2}}$

2. $16^{\frac{3}{4}} \div 9^{\frac{3}{2}}$ can be simplified to which of the following expressions?

- A. 2 B. $\frac{1}{216}$ C. $\frac{8}{27}$ D. $\frac{1}{2}$

3. Which of the following is the correct simplification of $\sqrt[3]{27m^6n^9}$?

- A. $9m^2n^3$ B. $3m^2n^3$ C. $3m^6n^6$ D. $9m^2n^6$

4. $\frac{3\sqrt{12}}{6\sqrt{15}}$ can be fully simplified to which of the following expressions?

- A. $\frac{1}{\sqrt{5}}$ B. $\sqrt{5}$ C. $\frac{4}{\sqrt{5}}$ D. $\frac{\sqrt{5}}{5}$

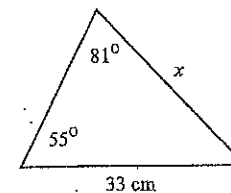
5. Which of the following is the answer to $3\sqrt{5} + \sqrt{20} + \sqrt{45}$?

- A. $16\sqrt{5}$ B. $3\sqrt{70}$ C. $8\sqrt{5}$ D. $3\sqrt{5} + \sqrt{65}$

6. Which of the following equalities is NOT correct?

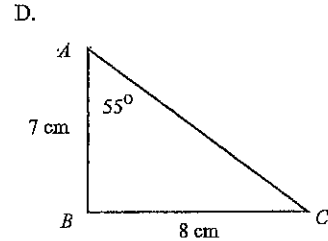
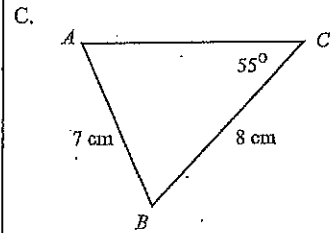
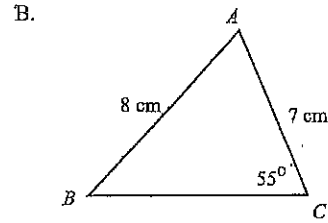
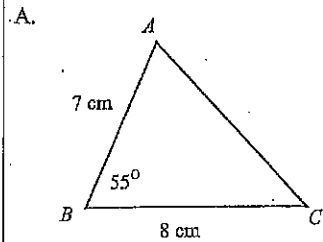
- A. $(\sqrt{7})^2 = 7$ B. $(2\sqrt{3})^2 = 12$ C. $(-\sqrt{5})^3 = -5\sqrt{5}$ D. $\sqrt{\frac{9}{4}} = \frac{3}{4}$

7. Which expression below will correctly calculate the value of x in the triangle?



- A. $\frac{x}{\sin 55} = \frac{33}{\sin 81}$
 B. $x^2 = 81^2 + 33^2 - 2 \times 81 \times 33 \times \cos 55$
 C. $\frac{x}{\sin 81} = \frac{33}{\sin 55}$
 D. $\tan 55 = \frac{x}{33}$

8. In $\triangle ABC$, $AB = 7$ cm, $BC = 8$ cm and $\angle ACB = 55^\circ$. Which of the following diagrams shows this information?



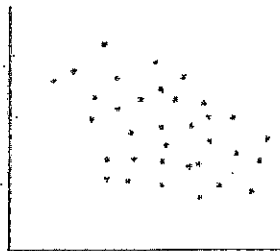
9. If $0 \leq \theta \leq 180^\circ$ and $\cos \theta = -\frac{\sqrt{3}}{2}$, what are the possible values of θ ?

- A. 30° B. 60° C. 120° D. 150°

10. The graph shows a scatterplot for a set of data.

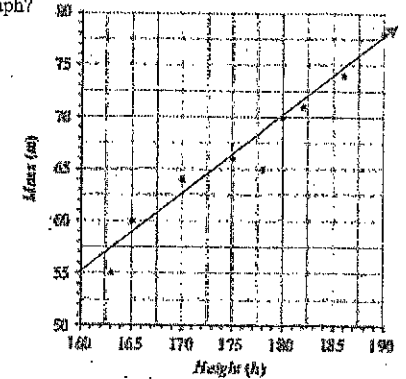
Which of the following is the best way to describe the correlation coefficient of this data?

- A. Strong positive
B. Weak positive
C. Weak negative
D. Strong negative



11. The scatterplot shows the relationship between the height and mass of 9 people.

Which of the following is NOT correct from the graph?



- A. The y -intercept is 55kg
B. The height of an 80 kg person is 190mm
C. The mass of a 175mm person is 65kg
D. The taller a person is, the heavier they are

12. If $a = 1$, $b = -3$ and $c = -7$, what is the correct value of $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ after substitution?

- A. $\frac{3 \pm \sqrt{37}}{2}$ B. $\frac{-3 \pm \sqrt{37}}{2}$ C. $\frac{3 \pm \sqrt{19}}{2}$ D. $\frac{-3 \pm \sqrt{19}}{2}$

13. Consider the quadratic equation $ax^2 + bx + c = 0$. If the value of $b^2 - 4ac$ is less than zero, then the equation will have how many solutions?

- A. None B. One C. Two D. Many

14. A quadratic equation was solved to find that the solutions were $x = 4$ and $x = -3$. What was the original equation?

- A. $x^2 + x - 12 = 0$ B. $x^2 - x - 12 = 0$ C. $x^2 - x - 1 = 0$ D. $2x - 1 = 0$

15. What is the correct solution to the equation $9x^2 - 4 = 0$?

- A. $\pm \frac{2}{3}$ B. $\pm \frac{3}{2}$ C. $\pm \frac{4}{9}$ D. $\pm \frac{9}{4}$

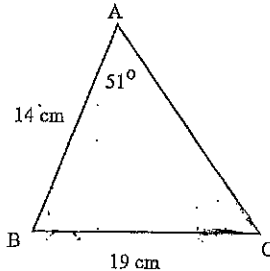
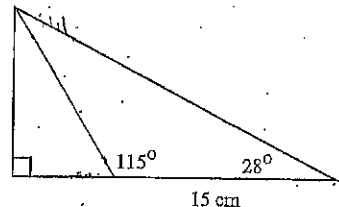
Section II: Extended response section

Show all working using clear and logical setting out.

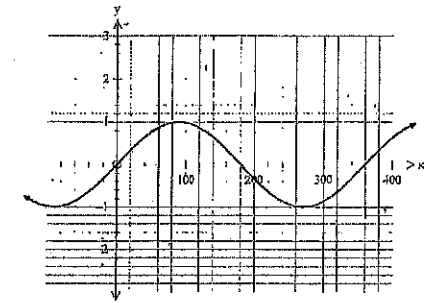
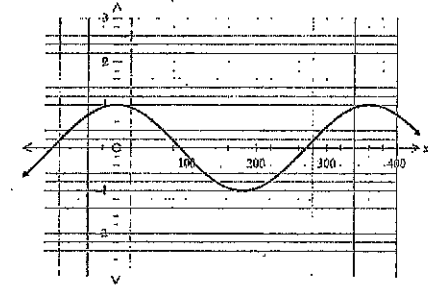
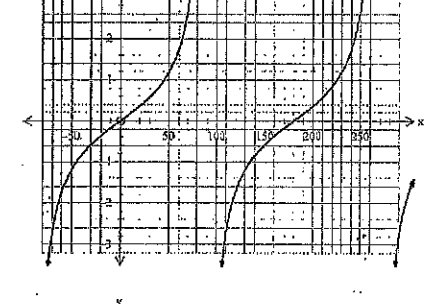
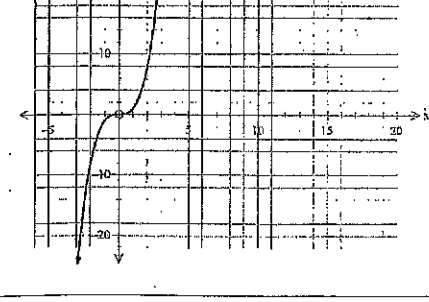
Part A: Indices		Marks
1.	Simplify the following, writing answers with positive indices	
	a) $3a^2 \times a^{-4} \times 2a^3 =$	1
	b) $4m^2 + 8m^{-3} =$	2
	c) $(3x^{-4})^2 =$	2
	d) $2(8y+z)^{-1} =$	1
2.	Simplify the following expressions, writing the answers in positive index form.	
	a) $\sqrt[3]{p} =$	1
	b) $\sqrt{16m^3} =$	1

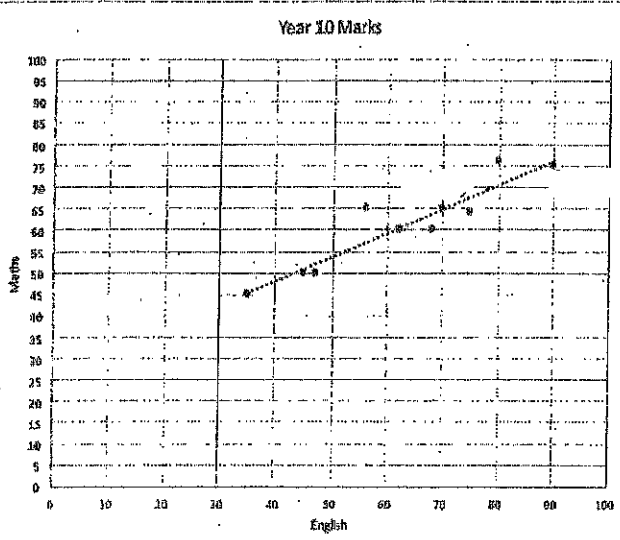
	c) $x\sqrt{x} =$	1
	d) $\frac{1}{\sqrt[3]{n}} =$	2
Part B: Surds		Marks
1.	Simplify	
	a) $3\sqrt{2} \times 5\sqrt{14} =$	2
	b) $5\sqrt{6} - 3\sqrt{2}(\sqrt{2} + 4\sqrt{3}) =$	2

2.	If $(a + \sqrt{2})^2 = m + 6\sqrt{2}$ where a and m are integers, find the values of a and m .	3
3.	<p>Rationalise the denominator</p> <p>a) $\frac{3}{2\sqrt{5}}$</p> <p>b) $\frac{1 + \sqrt{2}}{5 - 2\sqrt{2}}$</p>	2 3

Part C: Non-Right Trigonometry		Marks
1.	<p>a) A triangle has sides of length 12 cm, 15 cm and 20 cm. Find the size of the smallest angle to the nearest degree.</p> <p>b) Determine the size of angle ABC to the nearest degree.</p>  <p>c) Evaluate x correct to 3 significant figures.</p> 	2 3 3

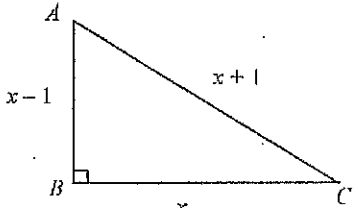
	<p>d) A light plane leaves Sydney and flies 1280km on a bearing of 050°. It then turns and flies for 3215 km on a bearing of 149°. How far is the plane from Sydney, to the nearest km?</p>	3
2.	<p>What is the exact value of $\cos 45^\circ - \sin 30^\circ$ when written in simplest form?</p>	2
3.	<p>Solve $\tan \theta = -\frac{1}{\sqrt{3}}$ to find θ to the nearest degree, where $0 \leq \theta < 180^\circ$.</p>	1
4.	<p>If $\sin \theta = \frac{3}{\sqrt{10}}$, find the exact value of $\cos \theta$.</p>	1

5.	<p>Which of the following is the graph of $y = \cos x$? Circle the correct letter.</p>	1
	<p>A</p> 	
	<p>B</p> 	
	<p>C</p> 	
	<p>D</p> 	

Part D: Bivariate Data		Marks
1.	<p>The scatterplot shows the marks gained by 10 students in Year 10 on their English and Maths exams.</p> <p>The line of best fit is started for you below.</p>  <p>a) Complete this statement: From the graph, the higher the English marks the _____ the Maths marks.</p> <p>b) Make an estimate for the value of the y-intercept.</p> <p>c) A student who scores 50 in English could expect what mark in Maths?</p> <p>d) Explain what would happen to a student's English mark if they scored 20% in Maths?</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>

	<p>e) Write a sentence which outlines a problem, or limitation, of this model.</p> <p>f) From the model, your mark in Maths depends on your mark in English. Do you agree or disagree? Explain your answer.</p>	<p>1</p> <p>1</p>
Part E: Quadratic Equations		Marks
1.	<p>Solve the following quadratic equations using the most appropriate methods</p> <p>a) $x^2 + 2x - 15 = 0$</p> <p>b) $3x^2 - 7x + 2$</p>	<p>2</p> <p>3</p>

2.	Use the quadratic formula to solve $3x^2 + 4x - 7 = 0$.	3
3.	Solve $m^2 - 8m - 3 = 0$ using the method of completing the square, giving the answer in exact form.	3
4.	Ten times an integer is added to seven times its square. If the result is 152, what was the original number?	3

5.	Solve $(x-5)(x+1) = 2(x-7)$, giving your answer exact.	3
6.	In the diagram, $\angle ABC$ is a right angle.	1
		2
a) Explain why $(x+1)^2 = x^2 + (x-1)^2$		
b) Solve to find the value of x .		

END OF TEST

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MC

1. B 2. B 3. B 4. A 5. C 6. D 7. A
 8. C 9. D 10. C 11. C 12. A 13. A 14. B
 15. A

Part A

1. a) $6a^3$
 b) $\frac{1}{2m^3}$
 c) $\frac{9}{x^2}$
 d) $\frac{2}{8y+z}$

2. a) $p^{\frac{1}{5}}$
 b) $4m^{\frac{3}{2}}$
 c) $x^{\frac{3}{2}}$
 d) $\frac{1}{n^{\frac{1}{2}}}$

Part B

1. a) $3\sqrt{2} \times 5\sqrt{14} = 3\sqrt{2} \times 5\sqrt{2}\sqrt{7}$
 $= 15 \times 2 \times \sqrt{7}$
 $= 30\sqrt{7}$

$-10 - 3\sqrt{2} (\sqrt{2} + \sqrt{3})$

$= 5\sqrt{6} - 6 - 12\sqrt{6}$

$= -7\sqrt{6} - 6$

c) $(a + \sqrt{2})^2 = a^2 + 2\sqrt{2}a + 2 = m + 6\sqrt{2}$

$2\sqrt{2}a = 6\sqrt{2}$

$2a = 6$

$a = 3$

$a^2 + 2 = m$

$9 + 2 = m$

$m = 11$

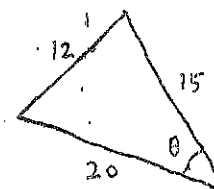
3. a) $\frac{3}{2\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{3\sqrt{5}}{10}$

b) $\frac{1+\sqrt{2}}{5-2\sqrt{2}} \times \frac{5+2\sqrt{2}}{5+2\sqrt{2}} = \frac{5+2\sqrt{2}+5\sqrt{2}+4}{25-8}$

$= \frac{9+7\sqrt{2}}{17}$

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a)



Smallest angle is opposite the smallest edge.

$12^2 = 15^2 + 20^2 - 2 \times 15 \times 20 \cos \theta$

$\cos \theta = \frac{15^2 + 20^2 - 12^2}{2 \times 15 \times 20}$

$\theta = \cos^{-1} \frac{15^2 + 20^2 - 12^2}{2 \times 15 \times 20}$

$= 37^\circ$

b) $\frac{\sin \angle ACB}{14} = \frac{\sin 51^\circ}{19}$

$\sin \angle ACB = \frac{14 \sin 51^\circ}{19}$

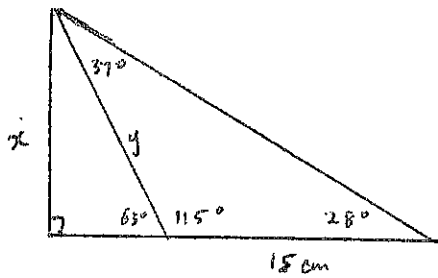
$\angle ACB = \sin^{-1} \frac{14 \sin 51^\circ}{19}$

$= 35^\circ$ (nearest degree)

$\angle ABC = 180 - 51 - 35$

$= 94^\circ$

c)

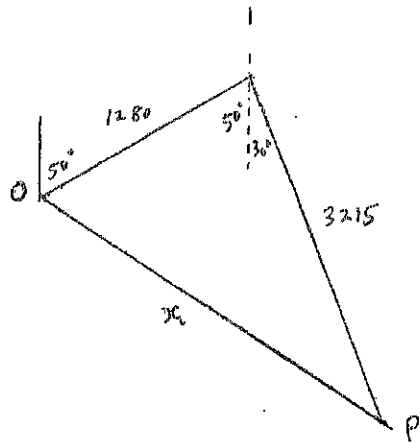


$$\frac{y}{\sin 28^\circ} = \frac{15}{\sin 37^\circ}$$

$$y = \frac{15 \sin 28^\circ}{\sin 37^\circ} = 11.7 \text{ cm}$$

$$x = y \sin 65^\circ = 11.7 \sin 65^\circ = 10.6 \text{ cm}$$

d)



$$x^2 = 1280^2 + 3215^2 - 2 \times 1280 \times 3215 \cos 80^\circ$$

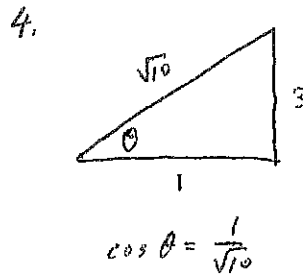
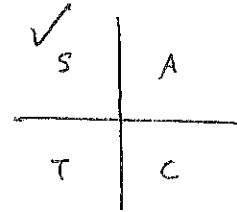
$$x = \sqrt{1280^2 + 3215^2 - 2 \times 1280 \times 3215 \cos 80^\circ} = 3247 \text{ km}$$

$$2. \cos 45^\circ - \sin 30^\circ = \frac{1}{\sqrt{2}} - \frac{1}{2} = \frac{\sqrt{2}-1}{2}$$

$$3. \tan d = \frac{1}{\sqrt{3}}$$

$$d = 30^\circ$$

$$\theta = 180^\circ - d = 150^\circ$$



$$\cos \theta = \frac{1}{\sqrt{10}}$$

5. B

1. a) higher

b) 25

c) 54

d) It would most likely be around 0.

e) The correlation between Maths marks and English marks is most likely much less linear for lower marks.

Also, using this model for Maths marks lower than 25 gives negative expected marks for English.

f) Yes, in the sense that the higher your Maths marks the higher your expected English marks.

No, in the sense that this does not mean your Maths marks directly affect your English marks. (This is called causality).

Part E

1. a) $(x+5)(x-3) = 0$
 $x = -5, 3$

b) $(3x-1)(x-2) = 0$
 $x = \frac{1}{3}, 2$

2. $x = \frac{-4 \pm \sqrt{16 + 84}}{6}$
 $= \frac{-4 \pm 10}{6}$
 $= \frac{-2 \pm 5}{3}$
 $= 1, -\frac{7}{3}$

3. $m^2 - 8m - 3 = 0$

$$m^2 - 8m + 16 = 16 + 3$$

$$(m-4)^2 = 19$$

$$m-4 = \pm\sqrt{19}$$

$$m = 4 \pm \sqrt{19}$$

$$7x^2 + 10x - 152 = 0$$

$$(7x+38)(x-4) = 0$$

$$x = 4$$

5. $(x-5)(x+1) = 2(x-7)$

$$x^2 - 4x - 5 = 2x - 14$$

$$x^2 - 6x + 9 = 0$$

$$(x-3)^2 = 0$$

$$x = 3$$

6. a) $\triangle ABC$ is a right angle triangle.

Hence, by Pythagoras' Theorem,

$$(x+1)^2 = x^2 + (x-1)^2$$

b) $x^2 + 2x + 1 = x^2 + x^2 - 2x + 1$

$$2x = x^2 - 2x$$

$$x^2 - 4x = 0$$

$$x(x-4) = 0$$

$$x = 4 \quad (\text{since } x > 0)$$