



Barker
College

Student's Name:

Teacher's Initials:

RJW* LZM

DXC LMD

DZP PDJ

YEAR 9

Tuesday PM 5th NOVEMBER

5.3 MATHEMATICS

TERM 4, 2019

SEMESTER 2 EXAMINATION

TOTAL TIME: 90 minutes

165 copies

INSTRUCTIONS TO STUDENTS:

This examination consists of TWO sections.

- * Write your name and teacher's initials in the spaces indicated.
- * A formula sheet is provided for use throughout the examination. Detach this sheet.

SECTION 1 : NON-CALCULATOR (20 minutes)

- * Calculators must NOT be used in this section.
- * Answer ALL questions in the spaces provided.
- * Show ALL necessary working.
- * Marks may not be awarded for careless or badly arranged work.
- * Diagrams are NOT drawn to scale.

SECTION 2 : CALCULATOR (70 minutes)

- * Calculators MAY be used in this section.
- * Answer ALL questions in the spaces provided.
- * Show ALL necessary working.
- * Marks may not be awarded for careless or badly arranged work.
- * Diagrams are NOT drawn to scale.

* * * *

	Your Mark	Marks
SECTION 1		30
SECTION 2		82
TOTAL		112

SECTION 1: NON-CALCULATOR

1. Simplify $5x^3 + 2x + 6x^3 - x$ 1

2. Express 51 048 in scientific notation. 1

3. Simplify $(y^4)^3 \div y^2$ 1

4. Factorise fully:
(a) $x^2 + 13x + 30$ 1

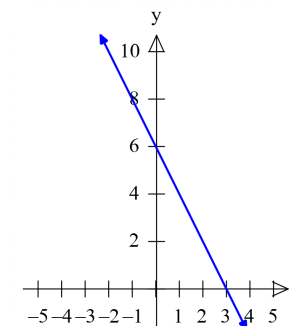
(b) $3a + 3b + ax + bx$ 2

5. Given that $y = \frac{3a^2+b^2}{a-b}$, find the value of y when $a = 2$ and $b = -1$. 2

6. Consider the line shown. 2

(i) What is the y intercept?

(ii) What is the gradient?



7. A dodecagon is a polygon that has 12 sides.

What is the size of an exterior angle of a regular dodecagon?

1

10. Find the simple interest earned if Ben invested \$300 at 10% per annum for 3 months.

2

8. Evaluate $125^{\frac{1}{3}}$

1

11. A solid cube has a surface area of 150 cm^2 . Determine its side length.

2

9. Lui used a stopwatch to measure in seconds, his speed in running a 30m sprint.



12. The midpoint of $P(-4, 7)$ and $Q(x, y)$ is $M(3, -3)$.

2

Determine the values of x and y .

- (i) What is the absolute error of Lui's recorded time?

1

- (ii) What is the range in values in which the actual measurement could lie?

1

13. Simplify: $\frac{5}{x+4} - \frac{3}{(x+1)(x+4)}$.

2

14. Simplify:

(a) $\frac{2\sqrt{9^4}}{9+3^2}$

3

(b) $\frac{(x^5y^2)^3y^2}{4^{-2}y^{-5}}$

3

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15. Express $2^3 + 4^3 + 8^3 + 16^3$ in the form $m(2^2)$.

2

End of Section 1: Non-Calculator



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TERM 4, 2019

SEMESTER 2 EXAMINATION

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SECTION 2: CALCULATOR

Time: 70 minutes

INSTRUCTIONS TO STUDENTS:

- Attempt ALL questions.
- Show ALL working.
- Approved calculators MAY be used.
- Write your answers in the spaces provided on the paper.
- Marks may not be awarded for careless or badly arranged work.
- Diagrams are NOT drawn to scale.
- A formula sheet is provided for use throughout this examination. Detach this sheet.

SECTION 2: There are EIGHT parts in this section.

Part	Topic	Your Mark	Marks
A	Algebra, Products & Factors		11
B	Trigonometry		8
C	Earning Money		13
D	Equations		10
E	Geometry, Congruence & Similarity		10
F	Co-ordinate Geometry & Simultaneous Equations		13
G	Surface Area and Volume		8
H	Mixed Questions		9
	Total		82

Part A: Algebra, Products & Factors (11 marks)

Question 1

Expand and simplify:

(a) $(3m + 5)(4m - 1)$

2

(b) $(2x - 3y)^2$

2

Question 2

Factorise completely:

(a) $2x^2 + 7x + 6$

2

(b) $1 - 9x^2$

2

Question 3

Fully **factorise**:

$$16(x + 3)^2 - 25$$

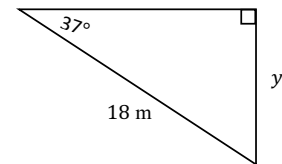
3

Part B: Trigonometry (8 marks)

Question 4

Find y correct to 2 decimal places.

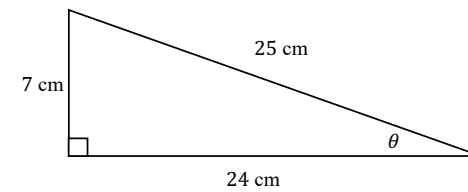
2



Question 5

Find θ to the nearest degree.

2



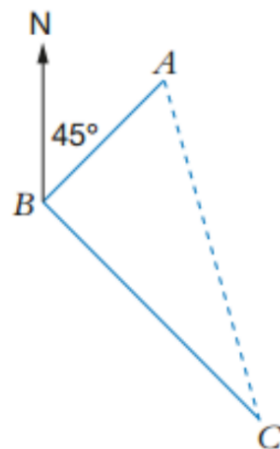
Question 6

The following information is given about three towns Allas (A), Bray (B) and Cuffe (C):

- Allas lies 9 km north-east of Bray
- Bray lies 15.2 km north-west of Cuffe

(i) Determine the size of angle $\angle ABC$. 1

(ii) Find the bearing (to nearest degree) of Allas from Cuffe. 3



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Part C: Earning Money (13 marks)

Question 7

Aiden works at the local McDonalds. He gets paid a basic hourly rate of \$15.40. He receives time-and-a-half for any Saturday work, and double time for Sunday work. 2

Determine Aiden's weekly pay for the following hours:

- Monday to Friday: 5 hours per day
- Saturday: 4 hours
- Sunday: 7 hours

Question 8

Michael paid \$22.80 to attend an exhibit. He had been given a 40% concessional discount. What was the original price? 2

Question 9

Matthew decided to put his piggy bank savings into an investment account. He deposited \$848 into the account that earns simple interest at R% p.a. 3
After 9 months had passed, his account had grown to \$906.
Determine the annual rate of simple interest R% that is applied to his account. (2 decimal places)

Question 10

Charlie is an engineer who earned \$108 400 one financial year. He also earned \$2 150 in interest from his investment portfolio. Charlie has \$4 860 in allowable tax deductions.

Throughout the year Charlie has paid \$29 500 in PAYG instalments.
The Medicare Levy is charged at 2% of **taxable income**

Resident tax rates 2019–20

Taxable income	Tax on this income
0 – \$18,200	Nil
\$18,201 – \$37,000	19c for each \$1 over \$18,200
\$37,001 – \$90,000	\$3,572 plus 32.5c for each \$1 over \$37,000
\$90,001 – \$180,000	\$20,797 plus 37c for each \$1 over \$90,000
\$180,001 and over	\$54,097 plus 45c for each \$1 over \$180,000

The above rates **do not** include the Medicare levy of 2%.

- (i) Show that Charlie's taxable income is \$105 690. 1
- (ii) Find the amount of income tax payable (not including the Medicare Levy). 2
- (iii) Determine the Medicare Levy payable. 1
- (iv) Determine the tax debt or tax refund amount payable. 2

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Part D: Equations (10 marks)

Question 11

Solve:

$$6(2x + 5) - 5(3x + 2) = x$$

2

Question 14

Make b the subject of the equation.

$$R = \sqrt{\frac{ax}{b+2}}$$

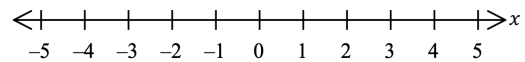
3

Question 12

Solve the following inequality and show the solution on the number line.

3

$$-5 \leq 1 - 3x$$



Question 13

The equation relating temperature in degrees Fahrenheit to degrees Celsius is given by:

2

$$F = 32 + \frac{9}{5}C$$

Find the temperature in degrees Celsius that is equivalent to 140 degrees Fahrenheit.

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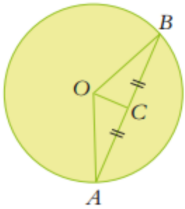
Part E: Geometry, Congruence & Similarity (10 marks)

Question 15

The circle below has centre O .

Prove that $\triangle AOC \equiv \triangle BOC$. Write a formal proof with full reasons.

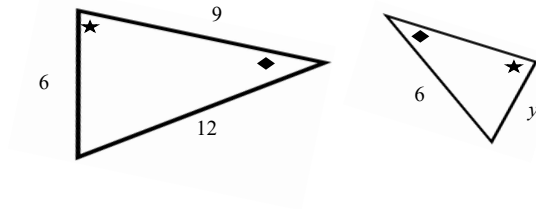
3



Question 16

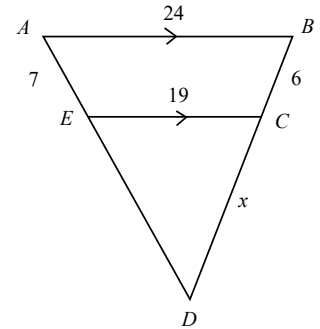
(a) Given that the triangles below are similar, determine the value of y . (NOT TO SCALE)

2



(b) Given that $\triangle DEC$ is similar to $\triangle DAB$, determine the value of x .

2



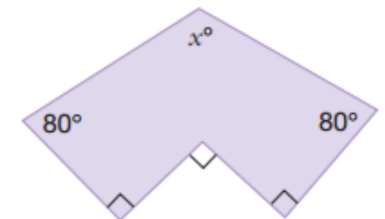
Question 17

(i) Show that the interior angle sum of a shape with 6 sides is 720° .

1

(ii) Determine the value of x in the diagram below.

2



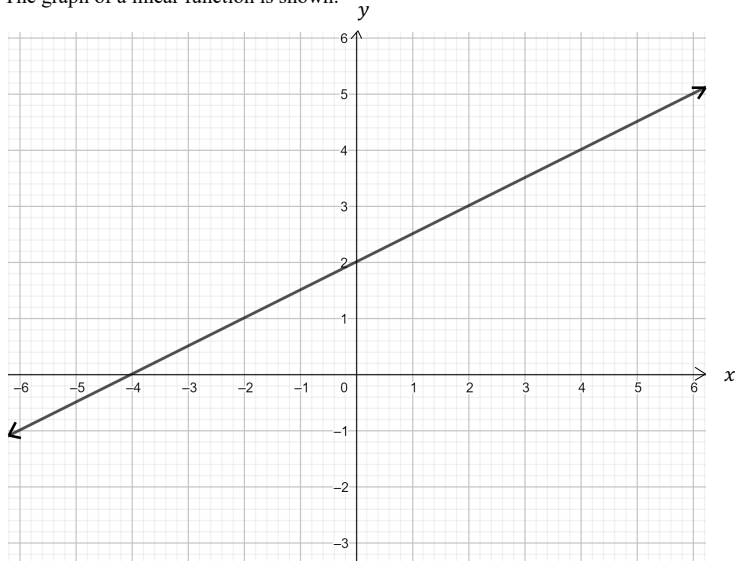
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Part F: Co-ordinate Geometry & Simultaneous Equations (13 marks)

Question 18

The graph of a linear function is shown.



(i) What is the gradient of the line? 1

(ii) Sketch the line $y = 5 - x$ on the axis above. 2

(iii) Using the graphical method or otherwise, solve the following equations simultaneously to find x and y . 1

$$y = \frac{1}{2}x + 2$$

$$y = 5 - x$$

Question 19

For the points $P(-1, 5)$ and $Q(3, -1)$

(i) Find the exact length of PQ . 2
Leave your answer as a surd.

(ii) Find the gradient of PQ . 2

(iii) What is the equation of the line parallel to PQ and passing through $R(-6, 2)$? 2
Give your equation in gradient-intercept form.

Question 20

Solve the following equations simultaneously to find x and y . 3

$$2x - 2y = 10$$

$$y = 1 - x$$

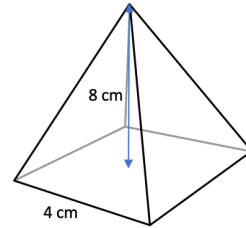
Part G: Surface Area & Volume (8 marks)

Question 21

A *square-based* right pyramid is shown.

- (i) Determine the volume of the pyramid. (2 d.p.)

2



- (ii) Determine the surface area of the pyramid. (2 d.p.)

3

Question 22

Roy's ice-cream parlour prepares ice-cream cones.

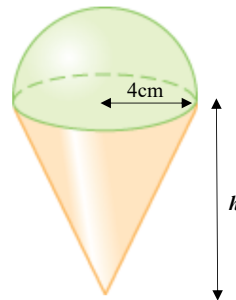
Each cone is completely filled and extra ice-cream is placed on top to make a perfect hemisphere.

Roy uses exactly 400 cm^3 of ice cream in each one he makes.

The cones he uses each have a radius of 4 cm.

Determine the height h of the cones he uses, in centimetres, correct to three significant figures.

3



Part H: Mixed Questions (9 marks)

Question 23

Fully simplify:

3

$$\frac{3x^2 - 48}{x^2 - 3x - 4} \div \frac{x^2 + 4x}{x^3 - x}$$

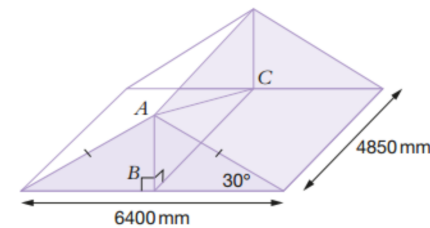
Question 24

The triangular prism shown represents part of a roof.

A wooden beam is to be fitted along AC as bracing for the roof.

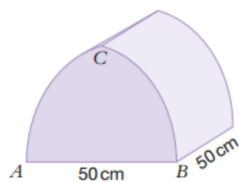
3

Find the value of AC correct to the nearest millimetre.



Question 25

Calculate the capacity, in litres, to two decimal places, of the solid shape shown below.



AC is an arc of a circle with centre B.
BC is an arc of a circle with centre A.

End of Paper

Year 9 5.3

Semester 2 Exam

Section 1

1) $11x^3 + x$

2) 5.1048×10^4

3) y^{10}

4) i) $(x+3)(x+10)$
b) $(3+x)(a+b)$

5) $\frac{13}{3}$

6) i) $y_{int} = 6$
ii) $m = -2$

7) 30°

8) 5

9) i) 0.005 seconds
ii) $4.265 \rightarrow 4.275$ seconds

10) \$7.50

11) 5 cm

12) $x = 10$ $y = -13$

13) $\frac{5(x+1)-3}{(x+4)(x+1)} = \frac{5x+2}{(x+4)(x+1)}$

14a) $\frac{2(9^4)^{\frac{1}{2}}}{18}$

$= 9$
b) $16x^{15}y^{13}$

15) $2^3 + 2^6 + 2^9 + 2^{12}$
 $= 1170(2^2)$

Section 2: Part A

1a) $12m^2 + 17m - 5$
b) $4x^2 - 12xy + 9y^2$

2a) $(2x+3)(x+2)$
b) $(1-3x)(1+3x)$

3) $(4(x+3)+5)(4(x+3)-5)$
 $(4x+17)(4x+7)$

Part B

4) $\sin 37 = \frac{y}{18}$
 $y = 10.83$ m

5) $\tan \theta = \frac{7}{24}$
 $\theta = 16^\circ$

6) 90°
ii) $\tan \theta = \frac{9}{15.2}$
 $\theta = 30.6299^\circ$

Bearing A \rightarrow C
 $= 270 + 45 + 30.6299^\circ$
 $= 345.6299^\circ$
 $\approx 346^\circ$

Part C

$$7) 25 + (4 \times 1.5) + (7 \times 2)$$

= 45 hours

$$45 \times 15.4 = \$693$$

$$8) x \times 0.6 = 22.8$$

$$x = \$38$$

$$9) 58 = (848)(R)(0.75)$$

$$R = 9.12\% \text{ (2dp)}$$

$$10i) 108400 + 2150 - 4860$$

$$= 105690$$

$$ii) 20797 + 0.37(105690 - 90000)$$

$$= \$26602.30$$

$$iii) 0.02 \times 105690 = \$2113.80$$

$$iv) 29500 - (26602.30 + 2113.80)$$

$$= \$783.9 \text{ refund}$$

Part D

$$11) 12x + 30 - 15x - 10 = x$$

$$x = 5$$

$$12) 3x \leq 6$$

$$x \leq 2$$



$$13) (140) = 32 + \frac{9}{5}C$$

$$C = 60^\circ$$

$$14) R^2 = \frac{ax}{b+2}$$

$$b+2 = \frac{ax}{R^2}$$

$$b = \frac{ax}{R^2} - 2$$

Part E

15) In $\triangle AOC$ and $\triangle BOC$

$AC = BC$ (given)

OC is common

$AO = BO$ (radii of circle are equal)

$$\therefore \triangle AOC \equiv \triangle BOC \text{ (SSS)}$$

$$16) a) \frac{y}{6} = \frac{6}{12}$$

$$y = 3$$

$$b) \frac{x}{x+6} = \frac{19}{24}$$

$$x = 22.8$$

$$17) i) 720^\circ$$

$$ii) 110^\circ$$

Part F

$$18) i) m = \frac{1}{2}$$

ii) y int of 5

x int of 5

$$iii) x = 2 \quad y = 3$$

$$19) i) d = \sqrt{(13 - (-1))^2 + ((-1) - (-6))^2}$$

$$d = \sqrt{52}$$

$$ii) m = -\frac{3}{2}$$

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

$$y = -\frac{3}{2}x - 7$$

20) sub ① into ②

$$2x - 2(1 - x) = 10$$

$$x = 3 \text{ (sub into ②)}$$

$$y = 1 - 3 \quad y = -2$$

Part G

$$21) i) V = 42.67 \text{ cm}^3$$

$$ii) x^2 = 8^2 + 2^2$$

$$x = \sqrt{68}$$

$$SA = 4\left(\frac{1}{2}(4)(\sqrt{68})\right) + (4 \times 4)$$

$$= 81.97 \text{ cm}^2 \text{ (2dp)}$$

$$22) V = \frac{1}{3}\pi r^2 h + \frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$$

$$400 = \frac{1}{3}\pi(4)^2 h + \frac{2}{3}\pi(4)^3$$

$$h = \frac{400 - \frac{2}{3}\pi(4)^3}{\frac{1}{3}\pi(4)^2}$$

$$h = 15.9 \text{ cm}$$

Part H

$$23) \frac{3(x^2 - 16)}{(x-4)(x+4)} \times \frac{x(x^2 - 1)}{x(x+4)}$$

$$= \frac{3(x-4)(x+4)}{(x-4)(x+4)} \times \frac{x(x+1)(x-1)}{x(x+4)}$$

$$= 3(x-1)$$



$$\tan 30 = \frac{x}{3200}$$

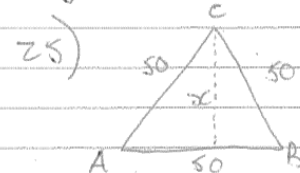
$$x = 1847.52 \text{ mm}$$



$$y^2 = x^2 + (4850)^2$$

$$y^2 = (1847.52)^2 + (4850)^2$$

$$y = 5190 \text{ mm (nearest mm)}$$



$\triangle ABC$ is equilateral

$$x^2 = 50^2 - 25^2$$

$$x = \sqrt{1875}$$

Area of the cross section

$$A_{cs} = \frac{60}{360}(\pi r^2) + \left(\frac{60}{360}(\pi r^2)\right) - \left(\frac{1}{2}bh\right)$$

$$= \frac{1}{6}(\pi 50^2) + \left(\frac{1}{6}(\pi 50^2)\right) - \frac{1}{2}(50)(\sqrt{1875})$$

$$= 1535.462123 \dots \text{ cm}^2$$

$V = A_{cs} \times \text{depth}$

$$= 1535.462123 \dots \times 50$$

$$= 76773.10616 \text{ cm}^3$$

$$C = 76773.10616 \text{ ml}$$

$$C = 76.77 \text{ L}$$