Name:	
Class:	

YEARLY EXAMINATION

YEAR 9 2017

MATHEMATICS

Time Allowed – 100 minutes plus 5 minutes Reading time.

INSTRUCTIONS:

- Start each section on a new page
- **Write your Name and Class at the top of each page**
- **Write** in **Pen** and draw diagrams in **Pencil**
- Department of Education approved calculators are permitted
- The use of mathematical templates are permitted.
- Show all necessary working
- Marks may not be awarded for untidy or carelessly arranged work
- No grid paper is to be used unless provided with the examination paper
- **Teachers: Please collect each section separately.**

Outcome	MC	A		B		C		D		E		Total
Measurement						1-3	/8	1-2	/7	4	/4	/19
Number		1	/2			4-5	/6					/8
Algebra		2-3	/6	1	/8			3-4	/10	1	/3	/27
Coord. Geom				2	/9					2	/4	/13
Geometry		4	/4							3	/6	/10
Stats and Prob		5	/5			6	/3					/8
MC	/5											/5
Total	/5		/17		/17		/17		/17		/17	/90

Multiple Choice – Answer on the Multiple-Choice Answer Sheet Provided

Question 1

Which of the following is a sufficiency proof for a rhombus?

a) Diagonals are perpendicular to each other

b) All sides are equal

c) Opposite sides are parallel

d) Diagonals bisect each other

Question 2

For a set of normally distributed data of 300 scores, how many scores are expected to have a z-score between -2 and 1?

a) 285

b) 245

c) 204

d) 180

Question 3

What is the value of $\theta°$?

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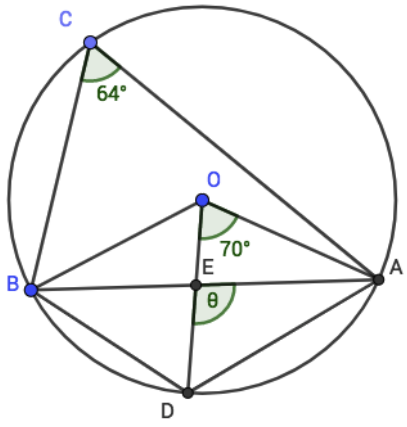


a) $96°$

b) $102°$

c) $106°$

d) $112°$

Question 4

How much interest is earned when $1500 is invested at 4% p.a. compounded monthly for 30 years?

a) $4970

b) $3470

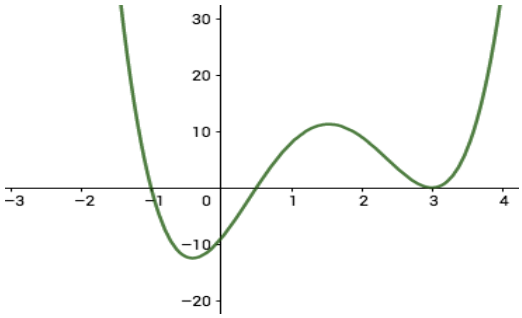
c) $4865

d) $3365

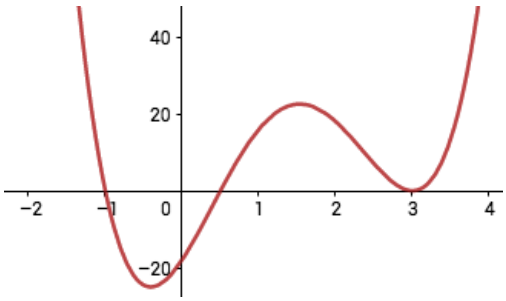
Question 5

Which if the following is the graph of $y = 2(x+1)(x-3)^2(2x-1)$?

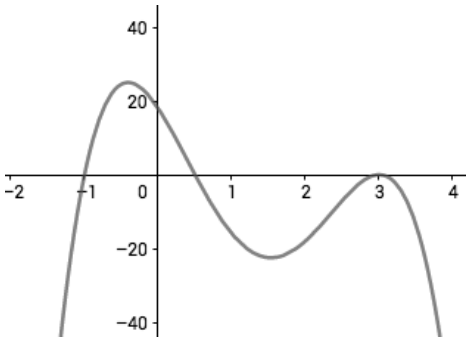
a)



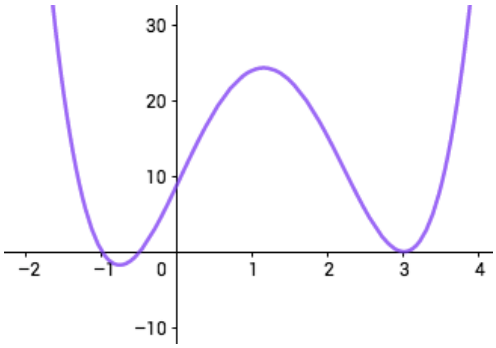
b)



c)



d)



END OF MULTIPLE CHOICE

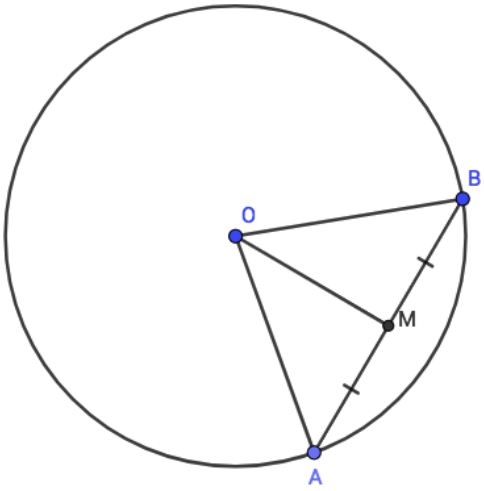
Section A: (17 Marks) Answer on your own writing paper

1. Rewrite $\frac{3+\sqrt{2}}{1+\sqrt{2}}$ in the form of $a+\sqrt{b}$ where a and b are both integers. 2

2. Expand and simplify:
   a) $(3x-4y)(2x+y)$ 1
   b) $(2a+b)(b-4)-(b+3)(a-b-1)$ 2

3. Factorise fully:
   a) $8x^3+y^3$ 1
   b) $4ax-5yb-4bx+5ay$ 2

4. In the diagram below, A and B are points on the circle with centre O. M is the midpoint of AB



   a) Prove that $\Delta AOM \equiv \Delta BOM$ using SSS. 2
   b) Hence, prove that the line drawn from the centre of a circle to the midpoint of a chord is perpendicular to the chord. 2

5. A group of 6 students took a test and got the following results:

   4, 5, 7, 8, 8, 10

   a) What is the mean of the scores? 1
   b) What is the standard deviation of the scores? 1
   c) What is the z-score of the lowest performing student in the group? 1
   d) A new student joins the class and took the same test. His score is 3 marks higher than the new mean. What score did the new student get? 2

PLEASE TURN OVER

Section B: (17 Marks) Start a new sheet of paper

1. Solve for the pronumerals of the following:

   a) $5x - 7 = 1 - 3x$ 2

   b) $\sqrt{x + 11} = 1 - x$ 3

   c) $3^{2x-y} = 27$

   $2^{3x+2y} = 4^{-3}$ 3

2. a) On a number plane, clearly label the points A(2, 1) and B(6,-1). (You may add to this diagram as the question progresses if necessary). 1

   b) Show that M, the midpoint of AB, has coordinates (4, 0). 1

   c) Show that l_1, the perpendicular bisector of AB is given by $2x - y - 8 = 0$. 2

   d) Show that C(5,2) lies on l_1. 1

   e) Is ΔABC an equilateral, isosceles or scalene triangle? Justify your answer. 2

   f) Find the coordinates of D, such that ABCD is a parallelogram. Show all necessary working. 2

PLEASE TURN OVER

Section C: (17 Marks) Start a new sheet of paper

1. Find the exact value of:

   a) $sin45°$ 1

   b) $cos210°$ 1

2. At 11am, a ship begins to set sail on a bearing of 130T from a position that is 50km due west of a lighthouse. The ship travels at a speed of 10km/h. At what time will the ship be directly South of the lighthouse? (Answer to the nearest minute). 3

3. a) What is the surface area of a closed cone with base radius 9cm and perpendicular height 40cm? 2

   b) If the dimensions of the cone are increased by 50%, what percentage will the surface area have increased by? 1

4. A car was bought for $25000. Each year its value depreciates by 12%.
   What is the market value of the car after 10 years? Express your answer correct to 5 significant figures. 2

5. Nick works as a real estate agent and receives a commission of 1% of all the sales he makes. In the financial year 2016-2017 he sold a total of $8.5 million dollars worth of homes. In addition, Nick also earned $1600 worth of interest from the bank, while spending $800 on work expenses and making $500 worth of donations that are tax deductible.

   a) Calculate Nick's taxable income for the financial year 2016-2017. 2

   b) Use the table below to work out the tax payable for Nick for the year. 2

Resident tax rates 2017–18

Taxable income	Tax on this income
0 – $18,200	Nil
$18,201 – $37,000	19c for each $1 over $18,200
$37,001 – $87,000	$3,572 plus 32.5c for each $1 over $37,000
$87,001 – $180,000	$19,822 plus 37c for each $1 over $87,000
$180,001 and over	$54,232 plus 45c for each $1 over $180,000

6. Helen bought 2 raffle tickets for a fundraiser. 3 tickets are drawn out of 100 for 3 different prizes. By drawing a probability tree diagram, find the probability of Helen winning exactly 1 prize? 3

PLEASE TURN OVER

Section D: (17 Marks) Start a new sheet of paper

1. The angle of depression from the top of a tower to Carmen's feet is $55°$. Carmen then walks a further 50m away from the tower, and from there the angle of elevation to the top of the tower is $35°$.

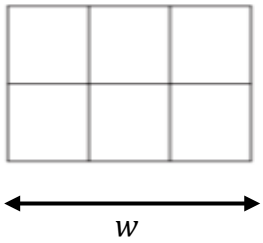
   a) Draw a neat diagram to illustrate all the information given above. 1

   b) Find the height of the tower correct to 1 decimal place. 3

   c) Using the 1 decimal place answer in part b, find to the nearest metre, the original distance between Carmen and the base of the tower. 1

2. Sketch the graph of $y = tanx$ for $0° \leq x \leq 360°$ 2

3. A window frame consisting of 6 congruent rectangles is illustrated below. Only 12 metres of frame is available for its construction.



   a) Show that the area of the window is given by $A = 3w - \frac{3w^2}{4}$ where w is the width of the window. 2

   b) Draw the graph $A = 3w - \frac{3w^2}{4}$ showing all important features 2

   c) Hence or otherwise, find the maximum area of the window. 2

4. a) By using the factor theorem and long division, factorise the function to linear factors:

$$f(x) = 4x^3 - 8x^2 - x + 2$$ 3

   b) Find the remainder when $f(x)$ is divided by $4x - 3$ 1

PLEASE TURN OVER

Section E: (17 Marks) Start a new sheet of paper

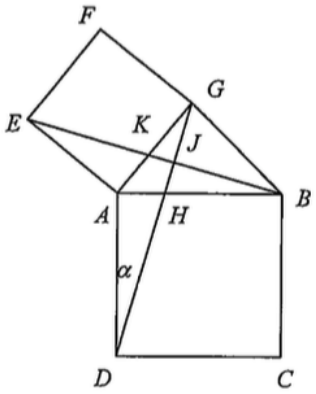
1. When a polynomial is divided by $x - p$, the remainder is p^2. When the same polynomial is divided by $x - q$, the remainder is q^2. What is the remainder when the polynomial is divided by $x^2 - (p + q)x + pq$? $(p \neq q)$. 3

2. a) Without finding the points of intersection, sketch and shade the region bounded by (and inclusive of) the following lines: 2

$$y = -\frac{1}{2}$$
$$x - y = 10$$
$$x = 4 - \frac{y}{2}$$

b) Write the correct set of inequalities to represent the region. 2

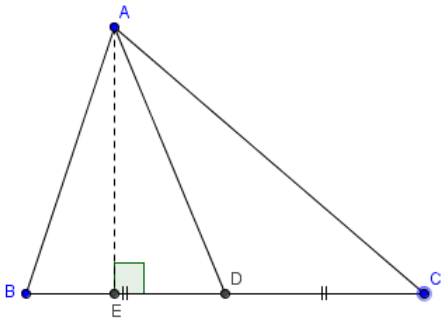
3. Two squares ABCD and AEFG are drawn above. AG and EB intersects at K and DG and AB intersect at H. Let $\angle ADG = \alpha$.



Not to scale

a) Copy the diagram neatly onto your paper and prove that $\Delta ADG \equiv \Delta ABE$ 3

b) Prove that $EB \perp DG$. 3

4. 

ΔABC is a scalene triangle with $AE \perp BC$. AD is the median from A such that $BD = DC$.

a) Show that $AD^2 - DE^2 = AB^2 - BE^2$ 1

b) Hence or otherwise, Prove that $AB^2 + AC^2 = 2(AD^2 + BD^2)$ 3

END OF TEST