

| STUDENT EDUCATION NUMBER |  |  |  |  |  |  |  |  |  |
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## Sāmoa Secondary Leaving Certificate

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# MATHEMATICS

# 2017

### QUESTION and ANSWER BOOKLET

Time allowed: 3 hours & 10 minutes

**INSTRUCTIONS:**

1. You have 10 minutes to read **before** you start writing.
2. Write your **Student Education Number (SEN)** in the space provided on the top left hand corner of this page.
3. Answer **ALL QUESTIONS**. Write your answers in the spaces provided in this booklet.
4. If you need more space for answers, ask the Supervisor for extra paper. Write your SEN on all extra sheets used and clearly number the questions. Attach the extra sheets at the appropriate places in this booklet.

**NB:** Formula Sheet is provided as a separate sheet.

| CURRICULUM STRANDS             | Page | Time (min) | Weighting  |
|--------------------------------|------|------------|------------|
| STRAND 1: ALGEBRA              | 2    | 22         | 12         |
| STRAND 2: COORDINATE GEOMETRY  | 4    | 25         | 14         |
| STRAND 3: GRAPHS AND FUNCTIONS | 6    | 25         | 14         |
| STRAND 4: SEQUENCE AND SERIES  | 8    | 25         | 14         |
| STRAND 5: PROBABILITY          | 12   | 25         | 14         |
| STRAND 6: CALCULUS             | 15   | 36         | 20         |
| STRAND 7: TRIGONOMETRY         | 19   | 22         | 12         |
| <b>TOTAL</b>                   |      | <b>180</b> | <b>100</b> |

Check that this booklet contains pages 2-21 in the correct order and that none of these pages are blank.  
**HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

- (a) Simplify  $\frac{2x^2 + 7x - 4}{2x^2 - 32}$

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- (b) State why the expression  $2x^2 + 7x - 4$  is not a linear equation.

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- (c) State ONE basic law of logarithm.

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- (d) Tana has a rectangular garden and he uses timber to form the sides. The length of the garden is  $y$  metres, and its area is  $150m^2$ .



- (i) Show that the perimeter of the garden is  $\frac{300}{y} + 2y$

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- (ii) If he uses 62m of timber to build the sides, find the dimensions of the garden.

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- (iii) What is the subject of the equation in (i) above?

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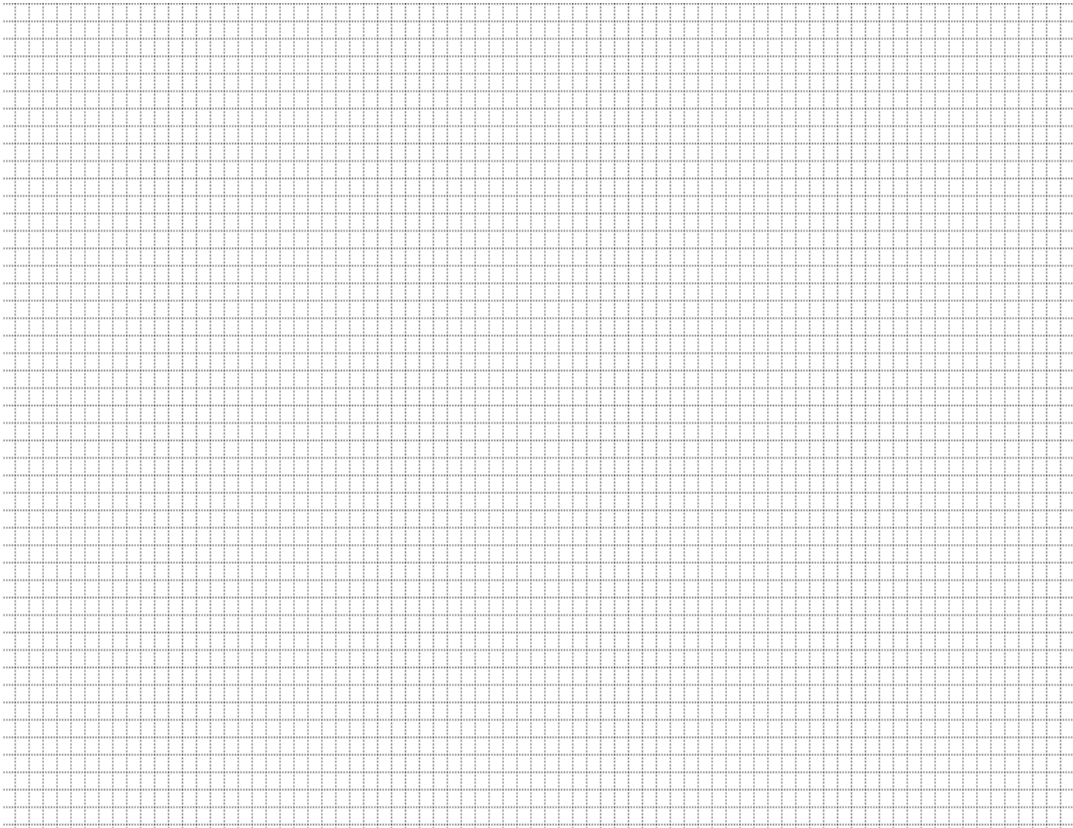
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- (iv) Give an equation of a cubic function.

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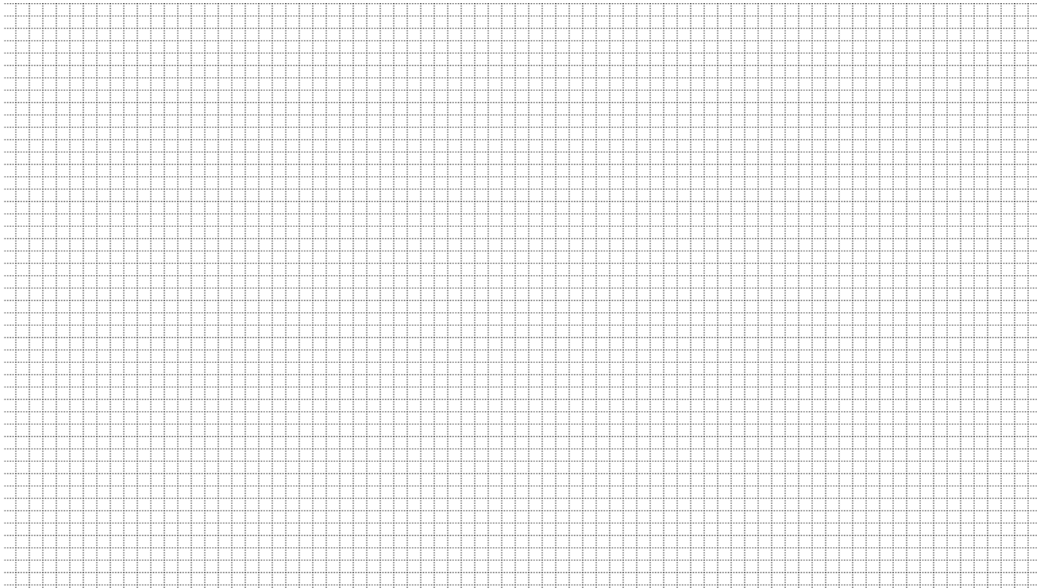
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- (a) The medians of a triangle intersect at a point called the centroid. Find the coordinates of the centroid,  $C$ , of the triangle  $PQR$  where the vertices of the triangle are  $P(-10, 8)$ ,  $Q(4, 10)$  and  $R(-12, 18)$ .  
A median is a line from the vertex to the midpoint of the opposite side. Plotting points and drawing lines is **NOT** sufficient.



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| SL 4 |
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- (b) Prove that the points A (-7, -4), B (5, 2) and C (7, 3) are collinear.  
Plotting points is **NOT** sufficient.



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- (c) Calculate the **midpoint** of the line joining the points (8, 10) and (12, -2).

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- (d) Find the **equation** of the line joining the points (8, 10) and (12, -2).

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- (e) Given the equation of a particular circle as  $(x-h)^2 + (y+k)^2 = r^2$ , determine:  
(i) the coordinates of its center

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(ii) its radius

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(f) If the center of the circle in (e) above is the origin, rewrite its equation in its simplest form.

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**STRAND 3:                      GRAPHS AND FUNCTIONS                      Weighting 14**

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1. The equation  $y = 3 - \frac{3}{x-1}$  is the equation of a \_\_\_\_\_ function.

*Fill in the space with the correct word.*

2. Given the function  $y = 3 - \frac{3}{x-1}$  as in 1, find the equation of the:

(a) horizontal asymptote

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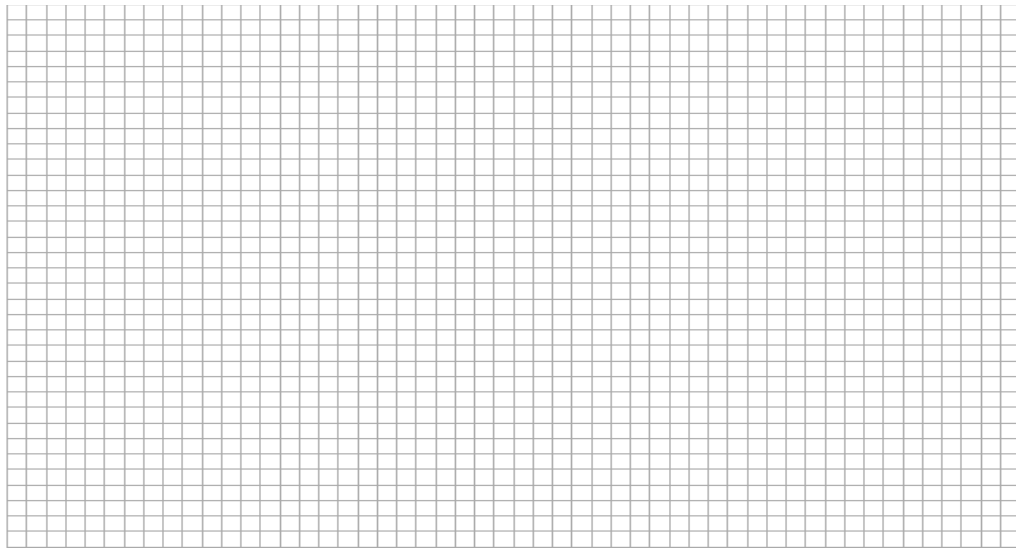
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(b) the vertical asymptote

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3. (a) Sketch the graph of  $y = 3 - \frac{3}{x-1}$  clearly marking the intercepts (x and y) and the asymptotes.



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- (b) Explain whether the function is continuous at  $x = 1$

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- (c) Show that  $y = 3 - \frac{3}{x-1}$  can be converted into a rational or fractional form.

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

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(d) Give the domain and range of the function  $y$ .

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(e) Explain whether the limit exists at  $x = 1$ ?

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**STRAND 4: SEQUENCE AND SERIES Weighting 14**

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1. Vasa begins a fitness programme. On the first day of his programme he runs 5 km. He runs 6.5 km on the second day. He runs 8 km on the third day. He continues to increase his daily run by the same distance each day.

(a) Give the **rule** (in equation form) that he could use to find the number of **km** he runs on any given day.

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(b) How far, **in total**, will he run in the first two weeks or 14 days?

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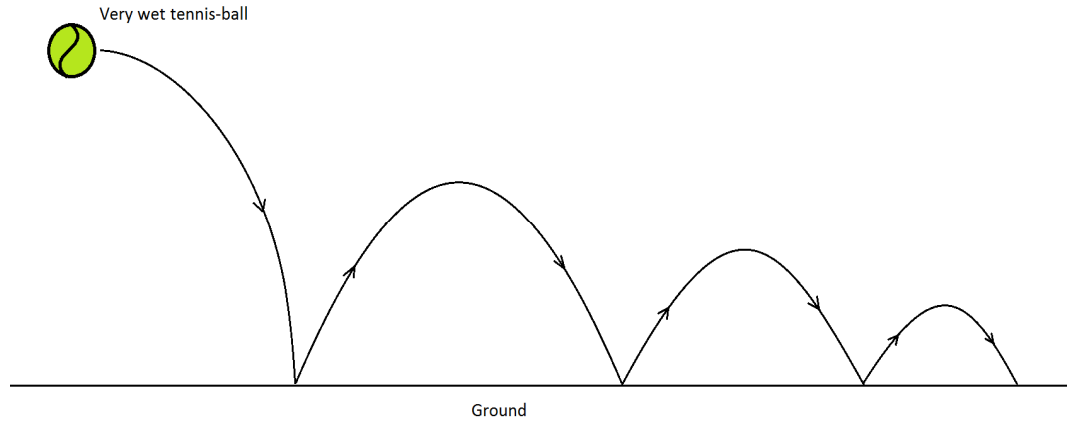
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| SL 2 |
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2. Tanu, like his friend Vasa, also begins his fitness programme. On the first day of his programme he runs 7 km. The distance he runs increases each day by 12% of the distance he runs the day before. If he keeps to his programme, what is the distance Tanu will run on the 14<sup>th</sup> day?

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3. When Simi drops a very wet tennis ball from a certain height to the ground, some quantities of water are removed from the ball. The first bounce removes 2g of water. Each successive bounce removes 20% of the amount removed by the previous one.



- (a) How much water is removed at the second bounce?

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- (b) Write down the sequence of the amounts of water removed at the first 4 bounces?

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- (c) Explain why the sequence in (b) above is a geometric sequence.

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- (d) Write an expression, in terms of  $n$ , for the amount of water,  $t_n$ , removed in the  $n^{\text{th}}$  bounce.

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- (e) For a geometric sequence with the common ratio  $r > 1$ , what can you say about the limit of such a sequence?

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4. At the start of Edna's training, her personal trainer says he will charge her \$50 a week. However, to encourage Edna, her trainer says that as long as she meets the goal he sets each week, he will charge her 8% less than he charged the week before ( $r = 0.92$ ).

How much could Edna expect to pay her personal trainer in **total** if this went on **indefinitely** as she met the goals?

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| SL 3 |
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1. Wilex Chocolate bars are produced on machines operated by shift workers. The weights of the bars are normally distributed with a mean of 40 grams and standard deviation of 0.8 grams.

- (a) What is the probability that a randomly chosen Wilex chocolate bar weighs between 40 and 41 grams?

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- (b) Between what weights will the middle 60% of Wilex chocolate bars lie?

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- (c) What percentage of chocolate bars weigh more than 41 grams?

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- (d) If Tanu's shift produced 10,000 chocolate bars, what is the expected number of chocolate bars that will weigh more than 41 grams?

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2. A pilot study investigated people showing symptoms of diabetes. The results were summarized in the table shown below.

| Gender | No symptoms of diabetes shown | Some symptoms of diabetes shown | Total |
|--------|-------------------------------|---------------------------------|-------|
| Male   | 167                           | 33                              | 200   |
| Female | 405                           | 195                             | 600   |
| Total  | 572                           | 228                             | 800   |

- (a) What proportion of people in the pilot study showed no symptoms of diabetes?

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| SL1 |
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- (b) What proportion of people in the pilot study were males and showed symptoms of diabetes?

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- (c) Show that for the people in the pilot study, the risk of showing some symptoms of diabetes is approximately **two out of seven**.

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- (d) A newspaper headline on the report stated, “**Pilot study shows females are three times more likely than males to show symptoms of diabetes.**”

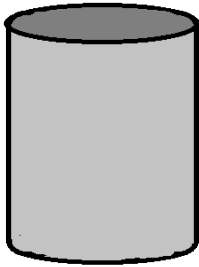
Show whether or not you agree with this headline, stating full reasons and calculations.

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| SL 4 |
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1. Samoa Post has a restriction on the size of cylinder shaped parcels that it will carry at a normal rate. The size of the parcel is at its maximum when the sum of its height and twice the radius is 180 cm.

Find the maximum possible volume of the parcel that can be carried at the normal rate.



SL 4

2. A function  $f$  is given by  $f(x) = 2x^3 - 10x + 5$

Find the gradient of  $f$  at the point where  $x = 2$

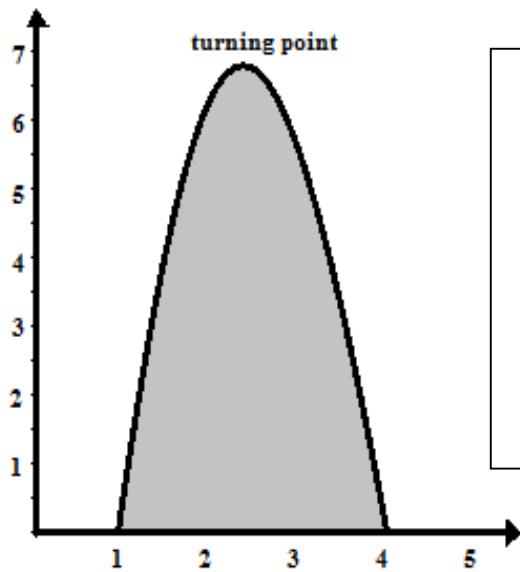
SL1

3. The gradient function of a curve is  $f'(x) = 8x^3 - 10x - 3$ .  
The curve passes through the point  $(1, -2)$

Find the equation of the curve.

SL1

4. (a) The graph below has the equation  $y = -3x^2 + 15x - 12$ .  
State the mathematical concept about the gradient function needed to enable calculation of the coordinates of the turning point?



SL 1

- (b) Find the coordinates of the turning point.

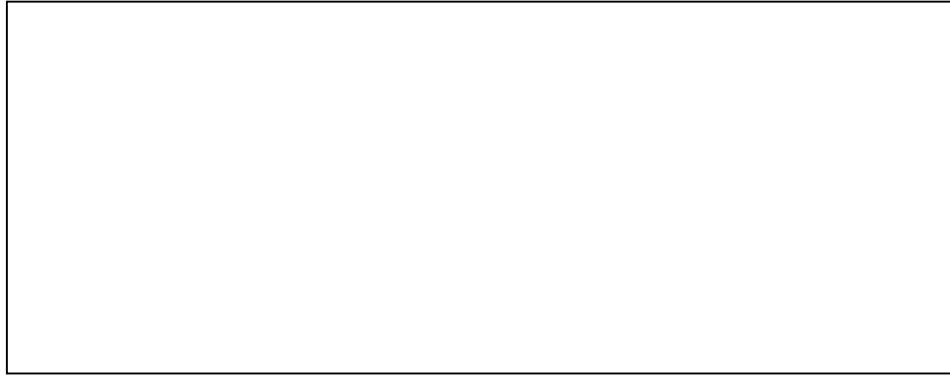
SL 2

- (c) Determine the nature of the turning point using the second derivative.

SL 2

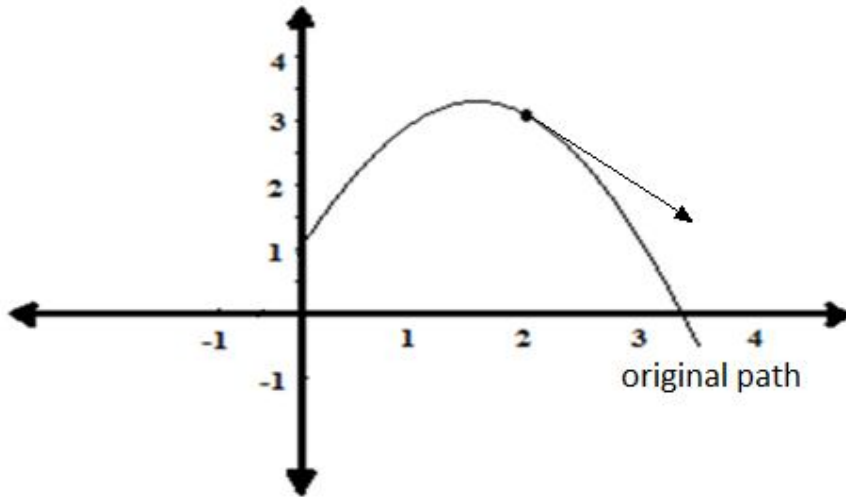
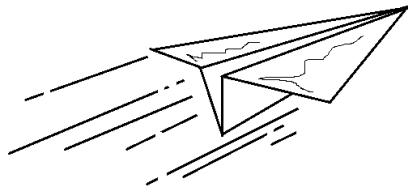


(d) Calculate the shaded area.



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(5) A dart (paper airplane) is thrown in the air. Its path relative to a set of axes is given by the equation  $y = -x^2 + 3x + 1$  (see diagram below). When  $x = 2$  the dart then continues on a straight line along a tangent to the original path.



(a) Give a label for the y – axes (vertical axes); what does it represent?



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| SL 1 |
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- (b) Can you describe what happens to the paper plane at the position (0,1), the y – intercept?

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- (c) Find **the equation of the path** that the dart follows after  $x = 2$ .

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6. Sio arrives home from work. He stops the car but does not apply the handbrake fully. The car begins to roll slowly downhill. It is 6 seconds before Sio realizes that the car is rolling. If the velocity of the car is given by  $v = 0.5t \text{ m/s}$  where  $v =$  velocity in metres per second and  $t =$  time in seconds from when the car begins to roll. How far has the car rolled in that time?

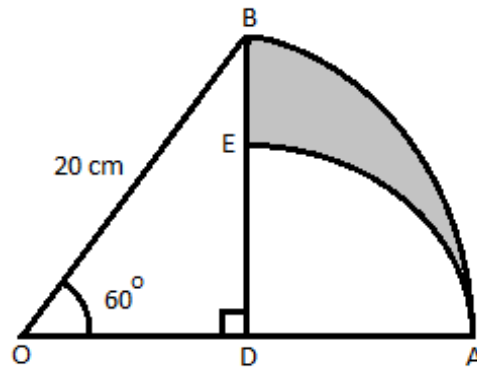
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1. A logo is designed as shown in the diagram below. A sector OAB, of angle  $60^\circ$  and radius 20cm is drawn. The perpendicular BD is dropped from B to OA and a quarter circle EAD centered at D is drawn.

Find the area of the shaded part, BAE. BD is a perpendicular bisector of ODA. Area of sector  $= \frac{1}{2} r^2 \theta$ .

*Hint:* Subtract the sum of area of triangle and quarter circle from area of sector.



SL 4

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2. Prove the identity  $\frac{\cos \theta}{\sec \theta - \tan \theta} = 1 + \sin \theta$

SL 3

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3. Solve this trigonometric equation for  $0^\circ \leq \theta \leq 360^\circ$

$$4\cos^2 \theta - 3 = 0$$

SL 3

4. Convert  $180^\circ$  to radians. Leave your answer in terms of  $\pi$ .

SL 1

5. State the cosine rule in determining the length of **side a** of a non-right angle triangle.

SL 1

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# MATHEMATICS

**2017**

*(For Scorers only)*

| CURRICULUM STRANDS             | Weighting  | Scores | Chief Scorer |
|--------------------------------|------------|--------|--------------|
| STRAND 1: ALGEBRA              | 12         |        |              |
| STRAND 2: COORDINATE GEOMETRY  | 14         |        |              |
| STRAND 3: GRAPHS AND FUNCTIONS | 14         |        |              |
| STRAND 4: SEQUENCE AND SERIES  | 14         |        |              |
| STRAND 5: PROBABILITY          | 14         |        |              |
| STRAND 6: CALCULUS             | 20         |        |              |
| STRAND 7: TRIGONOMETRY         | 12         |        |              |
| <b>TOTAL</b>                   | <b>100</b> |        |              |