

Name: \_\_\_\_\_

Material: E-Math Mock Paper 1



**OVERMUGGED MOCK PAPER 2021  
SECONDARY 4 EXPRESS  
SECONDARY 5 NORMAL ACADEMIC**

**ELEMENTARY MATHEMATICS**

**4048/01**

**Specimen Paper**

**Date: 1 September 2021**

**Duration: 2 hours**

**Candidates answer on separate writing paper**

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**READ THESE INSTRUCTIONS FIRST**

Write your name on all work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures.

Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value of **3.142**, unless the question requires the answer in terms of  $\pi$ .

At the end of the exam, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question

The total number of marks for this paper is **80**.

Setter: Ong Kai Wen

**This question paper consists of 22 printed pages including the cover page**

**MATHEMATICAL FORMULAE**

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*Compound interest*

$$\text{Total amount} = P \left( 1 + \frac{r}{100} \right)^n$$

*Mensuration*

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

*Trigonometry*

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

*Statistics*

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left( \frac{\sum fx}{\sum f} \right)^2}$$

1. Write the following numbers in order of size, starting with the largest

$$\left(\frac{6}{7} - \frac{5}{8}\right), \quad 0.2, \quad 0.2\bar{3}, \quad 0.20\bar{3}$$

*Answer* ..... [1]

[S4 HSS P1/2020 PRELIM QN 1]

[Total: 1 mark]

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2. (a) Factorise the following completely

$$x^2 + 9y^2 - 6xy - 1$$

*Answer* ..... [2]

- (b) Express the following as a single fraction

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

*Answer* ..... [2]

[S4 ANDSS P1/2020 PRELIM Qn 2]

[Total: 4 marks]

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3. Show that the following is divisible by 5 for all positive integer values

$$3^{3x+2} - 9^{\frac{3}{2}x} + (27)^{x+1}$$

*Answer* ..... [2]

[S4 AHS P1/2020 PRELIM Qn 4]

[Total: 2 marks]

- 
4. Mrs Huang bought some chicken floss buns and hotdog buns for an outing. The ratio of the number of chicken floss buns to the number of hotdog buns bought was 11:7. At the end of the outing, the number of each type of buns left was 4. The ratio of the number of chicken floss buns to the number of hotdog buns consumed was 8:5. Calculate the total number of buns that Mrs Huang bought

*Answer* ..... [4]

[S4 BGSS P1/2020 PRELIM Qn 21]

[Total: 4 marks]

5. A farm rears chickens and sheep. Each chicken has 2 legs and each sheep has 4 legs. The total number of legs is **100** while the total number of heads is **35**. Find the number of chickens and sheep in the farm

**Note:** You are not allowed to use “Guess-and-Check” to solve this question

*Answer* ..... [3]

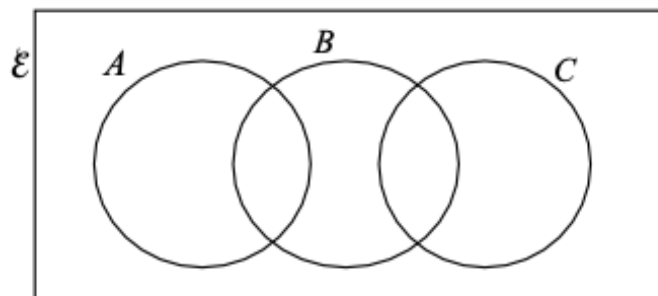
[S4 BPGHS P1/2020 PRELIM Qn 6]

[Total: 3 marks]

6. On the diagram below, mark and label a point to represent element  $x$  given the following

$$\begin{aligned} \{x\} &\subset (A \cap B) \cup C \\ x &\notin A \\ B &= \{w, y, z\} \end{aligned}$$

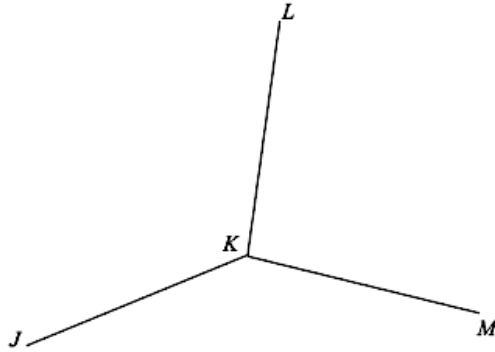
*Answer:*



[S4 CHIJ CHIJS P1/2020 PRELIM Qn 6(b)]

[Total: 1 mark]

7.



In the diagram,  $JK$  and  $KM$  are two sides of a regular decagon.  $JK$  and  $KL$  are two sides of a regular hexagon

(a) Calculate the interior angle of the regular decagon

*Answer* ..... [1]

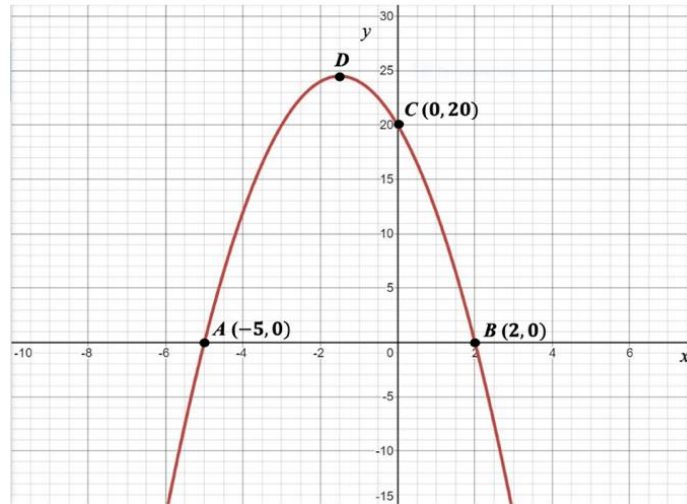
(b) Explain if  $MK$  and  $KL$  are two sides of a regular polygon. Show your working clearly

*Answer* ..... [3]

[S4 HIHS P1/2020 PRELIM Qn 20]

[Total: 4 marks]

8.



The graph of the following curve is drawn below. It cuts the axes at points *A*, *B* and *C*

$$y = -2(x^2 + 3x - 10)$$

(a) Find the coordinates of the maximum point *D*

*Answer* ..... [1]

(b) Write down the equation of the line of symmetry of the graph

*Answer* ..... [1]

(c) Use the graph to solve the equation

$$x^2 + 3x - 10 = 4$$

*Answer* ..... [2]

(d) Explain why the equation does not have solutions for some values of *k*

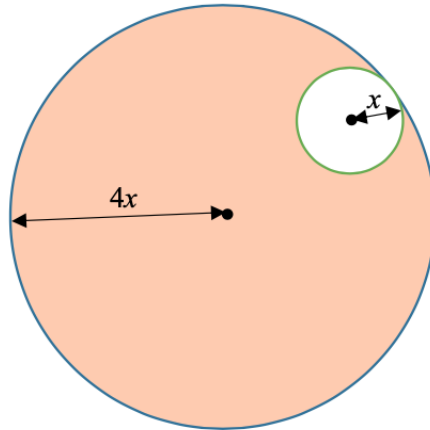
$$-2(x^2 + 3x - 10) = k$$

*Answer* .....  
 .....  
 .....  
 ..... [1]

[S4 HYSS P1/2020 PRELIM Qn 9]

[Total: 5 marks]

9.



The diagram shows two circles with radii  $x$  and  $4x$ . A point is chosen, at random, inside the larger circle. Find, in the simplest fractional form, the probability that this point is in the shaded area

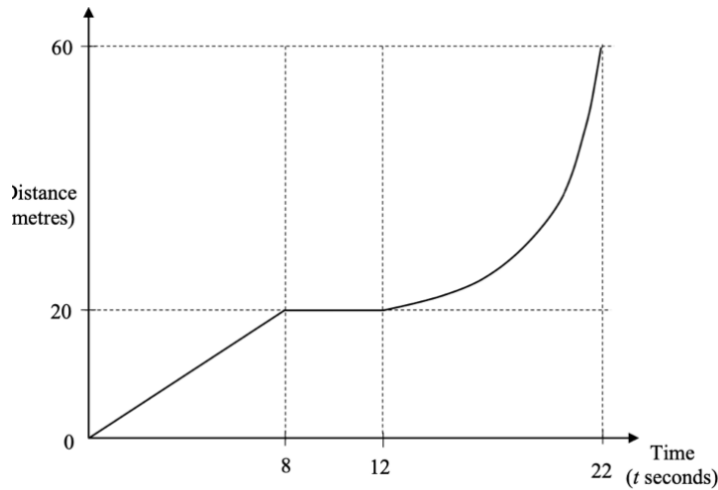
*Answer* ..... [2]

[S4 MSS P1/2020 PRELIM Qn 7]

[Total: 2 marks]



10.



The diagram above shows the distance-time graph of the first 22 seconds of a journey

(a) Find the speed during the first 8 seconds

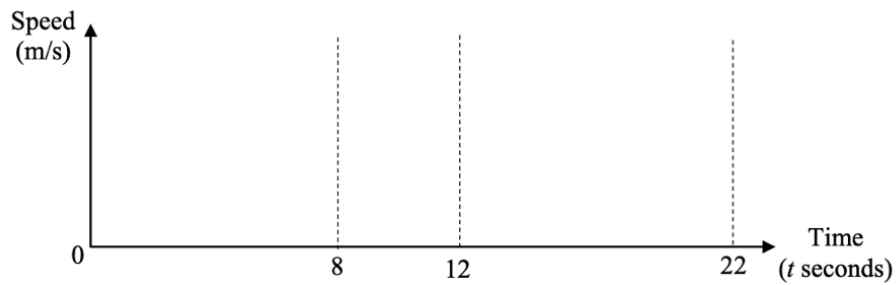
*Answer* ..... [1]

(b) What is the acceleration when  $t = 4$

*Answer* ..... [1]

(c) It is given that the speed increases at a uniform rate between  $t = 12$  and  $t = 22$ , and the speed is 8 m/s when  $t = 22$ . Sketch the speed-time graph for the first 22 seconds in the axes below

[2]



(d) Change 8 m/s into kilometres per hour

*Answer* ..... [1]

[S4 MGS P1/2020 PRELIM Qn 15]

[Total: 5 marks]

11. Two bottles of hand sanitisers are geometrically similar. The height of the smaller bottle and larger bottle are **10 cm** and **19 cm** respectively. The price of the smaller and larger bottle are **\$4.90** and **\$15.10** respectively. Explain which bottle gives the better value for money

*Answer* ..... [3]

[S4 NHHS P1/2020 PRELIM Qn 4]

[Total: 3 marks]

- 
12. (a) It takes 6 people to lay an area of tiles in 8 days. How long will it take if there are 16 people to do the same job?

*Answer* ..... [1]

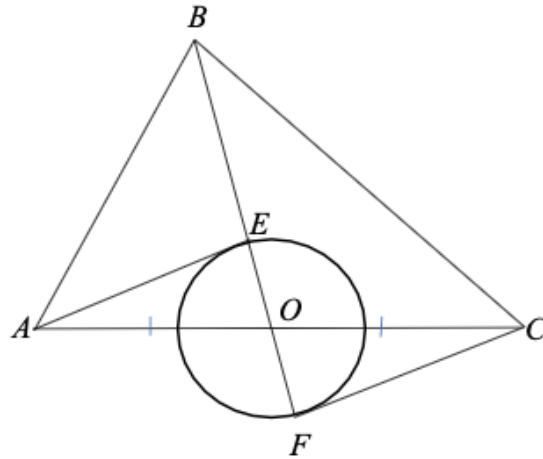
- (b) The intensity,  $I$ , of a light source on an object is inversely proportional to the square of distance,  $d$ , between the light source and the object. If the distance between the light source and the object is decreased to 40% of the original distance, calculate the percentage increase in the intensity of the light source on the object

*Answer* ..... [2]

[S4 NGHS P1/2020 PRELIM Qn 10]

[Total: 3 marks]

13.



In the diagram,  $OA = OC$ ,  $AE$  and  $FC$  are tangents to the circle with centre  $O$ .  $OE$  and  $OF$  are radii of a circle.  $BF$  is a straight line passing through point  $E$  and  $O$

(a) Show that triangle  $OAE$  and triangle  $OCF$  are congruent. Give a reason for each statement you make

[3]

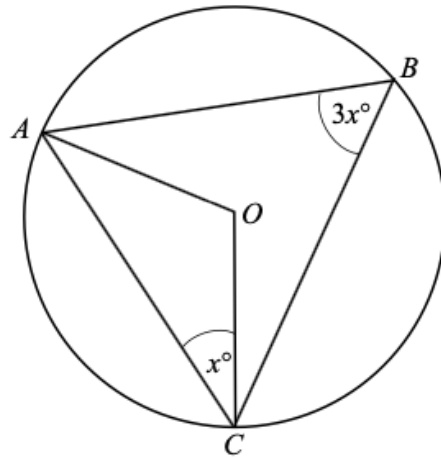
(b) Points,  $P$  and  $Q$  lie on the circumference of the circle such that triangle  $APE$  is congruent to triangle  $CQF$ . On the diagram, mark the positions for the points,  $P$  and  $Q$

[1]

[S4 PCSS P1/2020 PRELIM Qn 14]

[Total: 4 marks]

14.



In the diagram,  $A$ ,  $B$  and  $C$  are points on a circle, centre  $O$ .  $\angle ACO = x^\circ$  and  $\angle ABC = 3x^\circ$

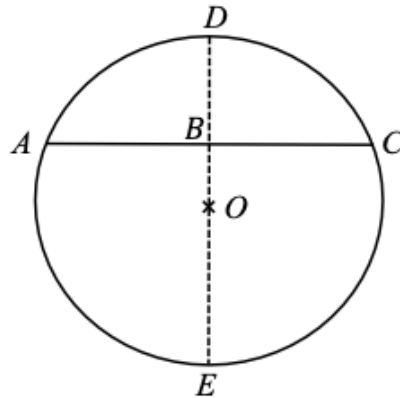
Find  $x$

Answer ..... [3]

[S4 QSS P1/2020 PRELIM Qn 16]

[Total: 3 marks]

15.



The diagram shows a circle, centre  $O$ , radius  $16\text{ cm}$ .  $B$  is the mid-point of the chord  $AC$ ,  $DE$  is a diameter and  $BE = 25\text{ cm}$

(a) Calculate  $\angle AOC$  in radians

*Answer* ..... [2]

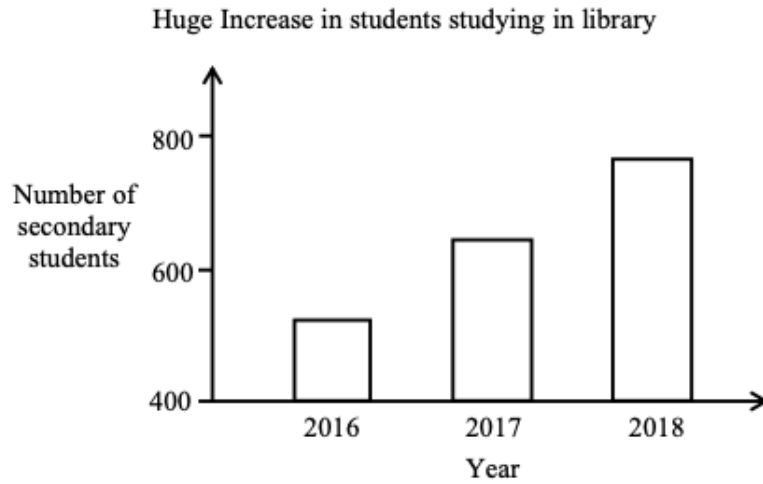
(b) Hence, find the area of the segment  $ABCE$

*Answer* ..... [3]

[S4 SST P1/2020 PRELIM Qn 19]

[Total: 5 marks]

16.



The graph below shows the number of secondary school students studying in the library between 2016 and 2018

(a) State one way in which the graph is misleading and explain why it is misleading

*Answer* .....

.....

.....

..... [1]

(b) Do you agree that the percentage of secondary school students studying in the library has been increasing between years 2016 to 2018

*Answer* .....

.....

.....

..... [1]

[S4 SMSS P1/2020 PRELIM Qn 5]

[Total: 2 marks]

17. (a) Solve the inequalities

$$-2 < \frac{2(7 + 5x)}{8} < 10$$

*Answer* ..... [2]

(b) Write down all the prime numbers that satisfy the above inequality

*Answer* ..... [1]

[S4 CHIJ SNGS P1/2020 PRELIM Qn 5]

[Total: 3 marks]

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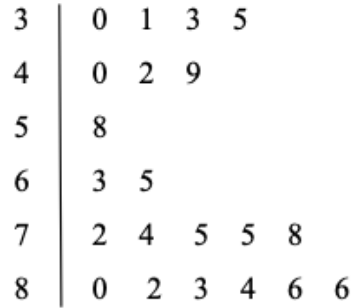
18. Mr Smith plans to invest his money in unit trust with a bank. His target is to earn an interest of \$10,000 after 5 years. The bank pays 3% compound interest per annum compounded yearly. Calculate, to the nearest hundred dollars, the minimum amount of money Mr Smith has to invest

*Answer* ..... [3]

[S4 TKSS P1/2020 PRELIM Qn 18]

[Total: 3 marks]

19.



Key 3 | 0 means 30 marks

The stem-and-leaf diagram shows the marks of 21 students who took a class test. The test was marked out of 100

- (a) Find the  
 (i) median mark

*Answer* ..... [1]

- (ii) interquartile range

*Answer* ..... [1]

- (b) A student said that the test was easy. Do you agree? Justify your answer

*Answer* .....

.....

.....

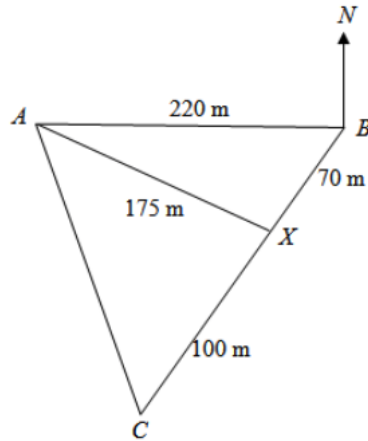
..... [2]

[S4 TSS P1/2020 PRELIM Qn 21]

[Total: 4 marks]



20.



*A*, *B* and *C* are three points on a horizontal field. *A* is 220 m due west of *B*. *X* is a point on *BC* such that *BX* = 70 m, *CX* = 100 m and *AX* = 175 m

(a) Calculate the bearing of *C* from *B*

Answer ..... [3]

(b) Calculate the shortest distance from *X* to *AB*

Answer ..... [3]

[S4 YISS P1/2020 PRELIM Qn 22]

[Total: 6 marks]

21. The line  $AB$  is drawn below

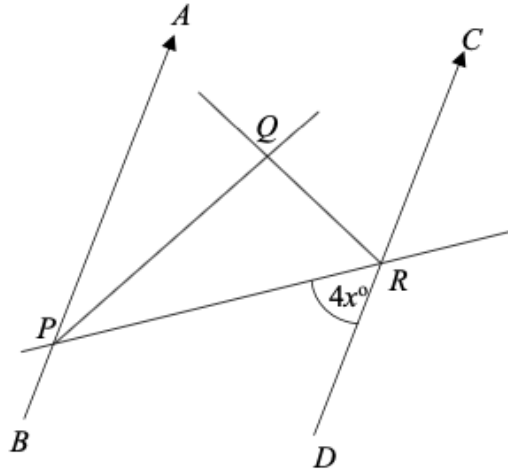
- (a) Construct triangle  $ABC$  where  $\angle ABC = 80^\circ$  and  $BC = 6$  cm [1]
- (b) Construct the bisector of  $\angle BAC$  [1]
- (c) Construct the perpendicular bisector of  $BC$  [1]
- (d) Mark clearly a possible point which is outside the triangle, equidistant from  $B$  and  $C$ , and nearer to  $AB$  than  $AC$ . Label this point  $P$  [1]



[S4 ZHSS P1/2020 PRELIM Qn 19]

[Total: 4 marks]

22.



In the figure,  $AB$  is parallel to  $CD$ .  $PQ$  and  $QR$  bisect  $\angle APR$  and  $\angle CRP$  respectively.

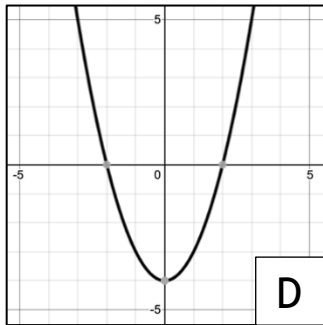
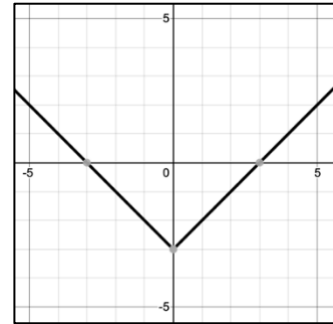
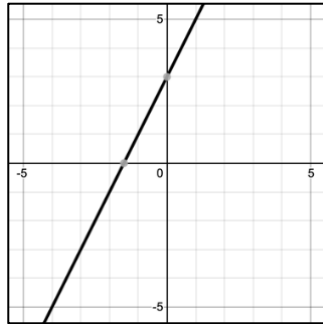
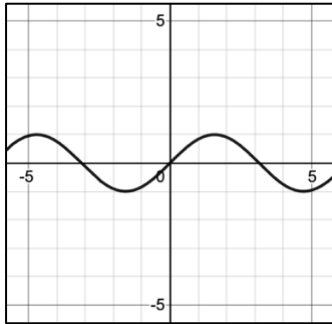
Given that  $\angle DRP = 4x^\circ$ , show that  $PQ$  is perpendicular to  $QR$

[3]

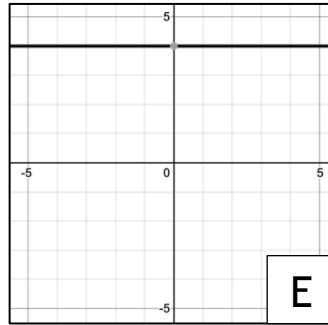
[S4 AHS P1/2020 PRELIM Qn 19]

[Total: 3 marks]

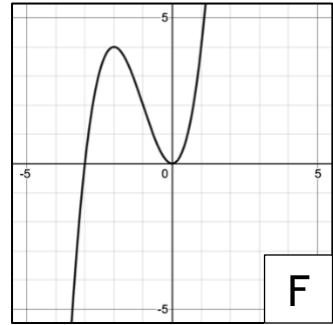
23.



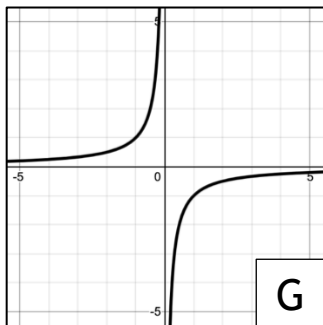
**D**



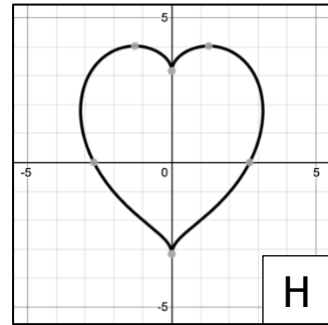
**E**



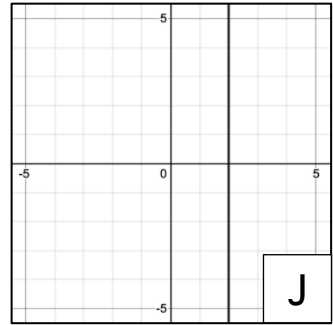
**F**



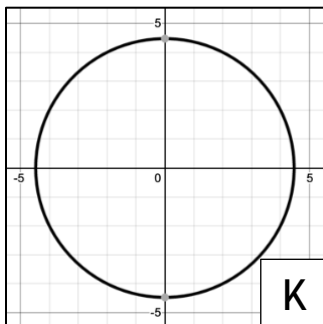
**G**



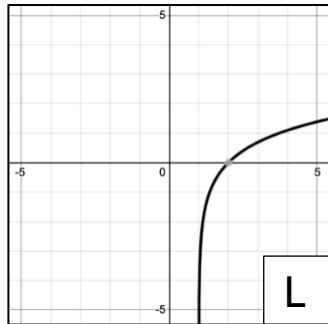
**H**



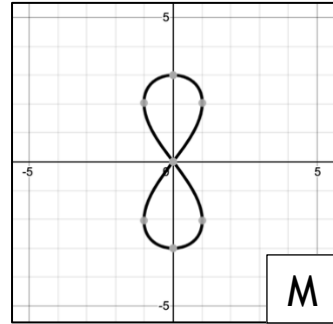
**J**



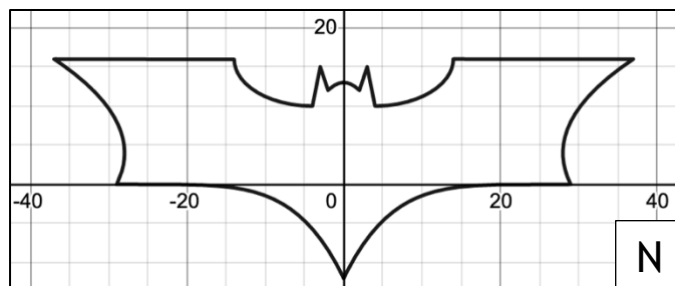
**K**



**L**



**M**



**N**

Each of the 13 plots on the previous page, labelled A to N, show graphs of varying equations. Answer the following questions. For some of the questions, the number of graphs required to get the full credit of the question is indicated at the end of each sub-part. No justification is required.

(a) Which of the following graphs passes through origin? (3 graphs)

[1]

(b) Which of the following graphs have only 1 line of symmetry? (4 graphs)

[1]

(c) Which of the following graphs are fully enclosed and when extended will not tend towards infinity? (4 graphs)

[Hint: Think about what does the phrase “fully enclosed” mean]

[1]

(d) Which of the following graph(s) will correspond to the line of symmetry of a quadratic curve of the form  $ax^2 + bx + c = 0$

[1]

- (e) **TWO** of the curves have its general-form equation labelled incorrectly. Take  $\alpha$  to be an arbitrary constant. Identify the error and relabel it with the correct equation in the blanks provided. Use the arbitrary constant  $\alpha$  if necessary

Graph	General-Form Equation
B	$y = mx + c$
D	$y = ax^2 + bx + c$
E	$x = \alpha$
F	$y = ax^3 + bx^2 + cx + d$
G	$y = \frac{\alpha}{x^2}$

Graph ..... Is labelled incorrectly. The correct equation should be .....

Graph ..... Is labelled incorrectly. The correct equation should be .....

[2]

[Total: 6 marks]

End of Paper ☺