



Calculator Model:

# KENT RIDGE SECONDARY SCHOOL PRELIMINARY EXAMINATION 2022

**MATHEMATICS**  
Paper 1

**4048 / 01**

**SECONDARY 4 EXPRESS /5 NORMAL ACADEMIC**

**Thursday 18 August 2022**

**2 hours**

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Name: \_\_\_\_\_ ( ) Class: \_\_\_\_\_

## READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.

**Do not open this question paper until you are told to do so.**

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

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

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.

The use of an approved scientific calculator is expected, where appropriate.

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 or 3.142, unless the question requires the answer in terms of  $\pi$ .

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

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

For Examiner's Use	
Total	80

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This Question Paper consists of **17** printed pages, including this page.

**Mathematical Formulae**

*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*

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

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

Answer **all** the questions.

1 Calculate  $\frac{-(-9) - \sqrt[3]{19 \times (-18)^2 - 4 \times (7-40)}}{3 \times 3.6}$ .

Answer ..... [1]

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- 2 Given that  $y$  is directly proportional to the  $(3x + 7)^2$ , and that  $y = 6$  when  $x = -4$ .  
(a) Express  $y$  in term of  $x$ .

Answer (a) ..... [2]

- (b) Hence, find the values of  $x$  when  $y = 15.36$ .

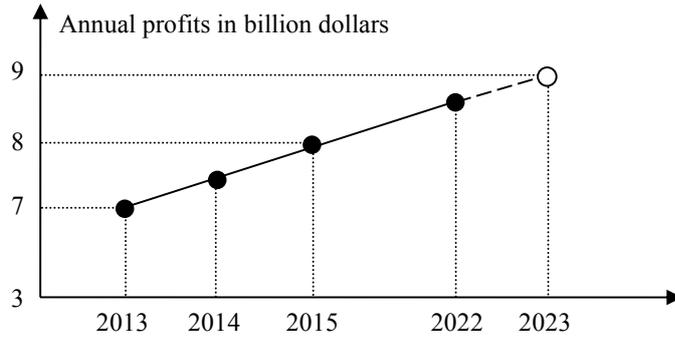
Answer (b) ..... [2]

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3 Simplify  $\frac{4}{aw^2} \div \frac{16a^3}{5w}$ .

Answer ..... [2]

- 4 A company used the following line graph to show the annual profits made over a period of time.



State one aspect of the graph that may be misleading and explain how the annual profits in 2023 can be projected wrongly.

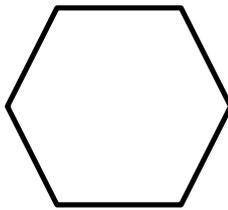
Answer .....

.....

.....

..... [2]

- 5 The ratio of the **area** of a regular hexagon : area of an equilateral triangle = 49 : 9.  
Show that the ratio of the **perimeter** of a regular heptagon : perimeter of triangle is 42 : 9.



Hexagon



Equilateral triangle

Answer

[2]

- 6** Town *A* and Town *B* are 100 km apart. At 0800, James departs for Town *B* from Town *A*, driving at a constant speed of 70 km/h. Kim departs at the same time as James for Town *A* from Town *B*, driving at a constant speed of 50 km/h. What time will James and Kim pass each other?

*Answer* ..... [3]

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- 7** A bag contains 2 gold balls,  $r$  red balls and  $s$  silver balls where  $r \times s$  is prime number and  $r < s$ . The total number of balls is 10.

- (a)** Find the probability of choosing a non-gold ball.

*Answer (a)* ..... [1]

- (b)** Find the probability of choosing a red ball.

*Answer (b)* ..... [2]

**8** Solve the equation  $\frac{x}{3} - \frac{3x-7}{4} = 8$

*Answer*  $x = \dots\dots\dots$  [3]

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**9** (a) Simplify  $-4(2a + b) + 7(b - 3a)$ .

*Answer* (a)  $\dots\dots\dots$  [2]

(b) Factorise completely  $12xy + 6x^2 - 2y - x$ .

*Answer* (b)  $\dots\dots\dots$  [2]

**10** Make  $b$  the subject of the formula  $3b + 8d = 2ab + 5$ .

*Answer* ..... [2]

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**11** In the Idol contest,  $\frac{7}{9}$  of the school's population decided to vote.

There were 3 contestants and the votes for these contestants were divided in the ratio of  $\frac{1}{3} : \frac{5}{6} : 0.5$ . Given that the school's population has 1440 students, calculate the number of students who voted for the contestant with the most votes.

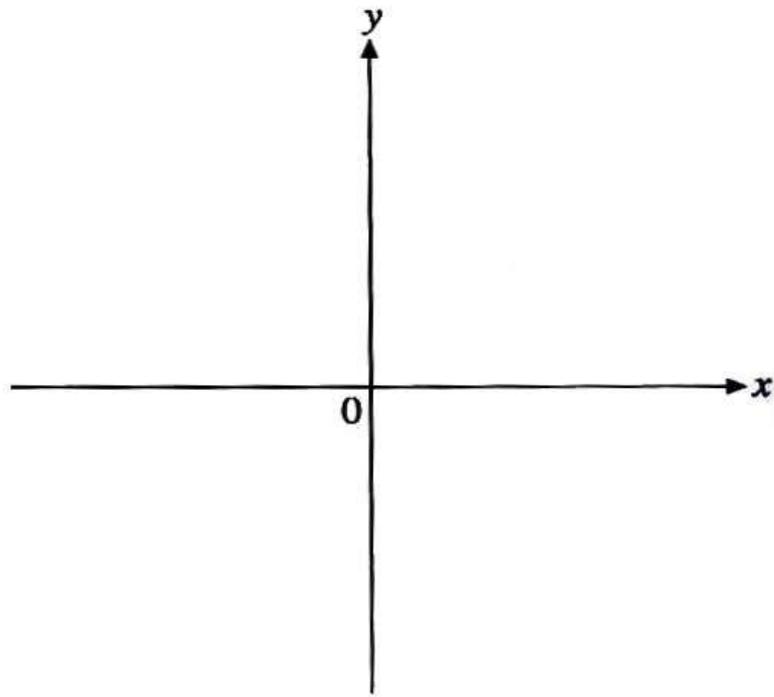
*Answer* ..... students [2]

**12 (a)** Express  $x^2 + 5x + 4$  in the form  $(x + p)^2 + q$ .

*Answer (a)* ..... [2]

**(b)** Sketch the graph of  $y = x^2 + 5x + 4$ .  
Indicate clearly the values where the graph crosses the  $x$ - and  $y$ - axes.

*Answer (b)*



[2]

**(c)** Write down the coordinates of the minimum point of the graph of  $y = x^2 + 5x + 4$ .

*Answer (c)* ( ..... , ..... ) [1]

**13** In 2010, the population of the United Kingdom was  $6.3 \times 10^7$ .

**(a)** In the same year the population of Singapore was  $4.7 \times 10^6$ .

How many more people lived in the United Kingdom than in Singapore in 2010?  
Give your answer in standard form, to 2 decimal places of accuracy.

*Answer (a)* ..... [2]

**(b)** In Singapore, John pays SGD\$2.98 for one litre of petrol.  
On a visit to United Kingdom, he paid £5.88 for five litres of petrol.

1 pound dollar (£) = 1.70 Singapore dollars (SGD).

Is the petrol cheaper in Singapore or United Kingdom and by how much?  
Give your answer in SGD\$.

*Answer (b)* ..... , SGD\$ ..... [3]

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**14** It is given that  $x$  is 20% lesser than  $m$  and  $y$  is 30% greater than  $n$ .

Determine if  $\frac{x}{y}$  is lesser or greater than  $\frac{m}{n}$ .

Show your working clearly.

*Answer* .....  
..... [3]

- 15** Mr Koh borrows \$950 at a rate of  $r$  % per year compounded **quarterly**.  
At the end of 10 years, he has paid \$2200.

Calculate the value of  $r$ .

*Answer*  $r = \dots\dots\dots$  [3]

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- 16 (a)** Given that  $2^a + 2^a + 2^a + 2^a = 32$ , find the value of  $a$ .

*Answer (a)*  $a = \dots\dots\dots$  [2]

- (b)** Solve the equation  $25^{x+2} \times 125 \div 5^{-x} = 1$ .

*Answer (b)*  $x = \dots\dots\dots$  [3]

- 17**  $P$ ,  $Q$  and  $R$  are points such that  $\angle PQR = 75^\circ$  and  $PR = 9$  cm.  
The line  $PQ$  has been drawn for you.

- (a)** Using compass, protractor and ruler only, construct the triangle  $PQR$ .

*Answer*



[2]

- (b)** Construct the perpendicular bisector of  $PQ$ . [1]

- (c)** Construct the angle bisector of  $\angle PQR$ . [1]

**18**  $\xi = \{x : x \text{ is an integer, } 4 \leq x \leq 16\}$

$A = \{4, 9, 16\}$

$B = \{4, 6, 7, 8, 9, 10, 16\}$

- (a) Draw a Venn diagram showing  $\xi$ ,  $A$  and  $B$  and place each of the elements in the appropriate part of the diagram.



[2]

- (b) Describe the elements in set  $A$ .

..... [1]

- (c) List the element(s) contained in the set  $A \cap B'$ .

Answer (c) ..... [1]

**19** The scale of a map is 2 cm to 1 km.

- (a) The actual length of a road is 8.5 km. Find the length of the road on the map in cm.

Answer (a) .....cm [1]

- (b) The area of a plot of land on the map is  $9 \text{ cm}^2$ .  
Find the actual area of the plot of land in  $\text{km}^2$ .

Answer (b) .....  $\text{km}^2$  [2]

**20**    **(a)**    Written as a product of its prime factors,  $360 = 2^3 \times 3^2 \times 5$ .

**(i)**    Find the prime factors of 756, giving your answer in index notation.

*Answer*    (a) (i)..... [2]

**(ii)**    Find the highest common factor of 360 and 756.

*Answer*    (a) (ii)..... [1]

**(b)**    Written as a product of its prime factors,  $9801 = 3^4 \times 11^2$ .

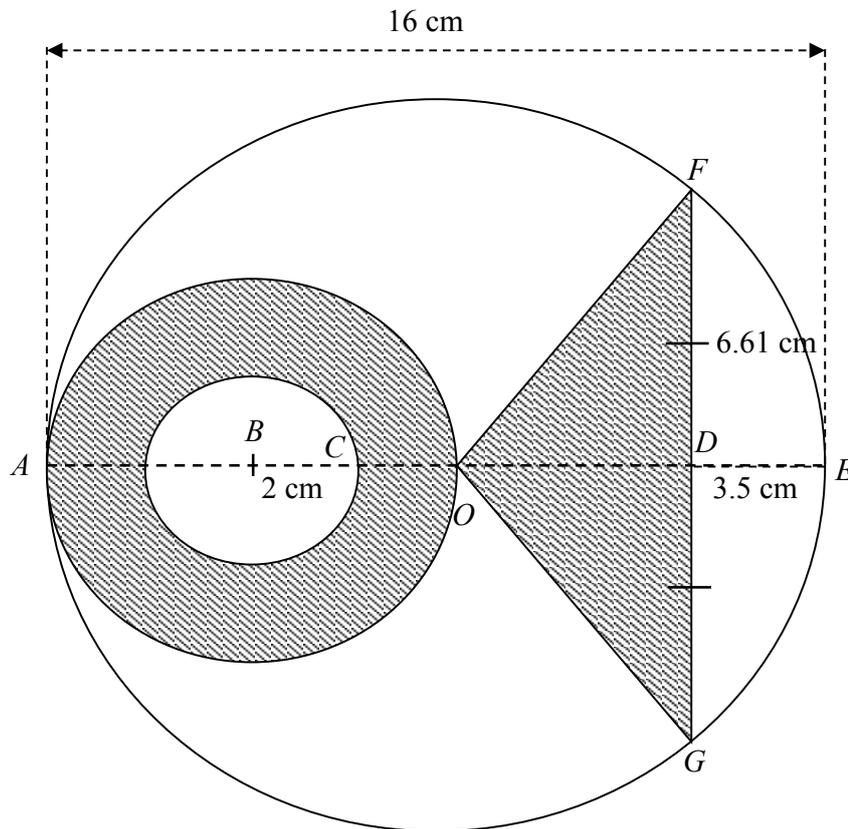
The number  $\frac{9801m}{n}$  is a perfect cube where  $m$  and  $n$  are prime numbers.

Find the values of  $m$  and  $n$ .

*Answer*    (b)  $m = \dots\dots\dots$ ,  $n = \dots\dots\dots$  [2]

- 21** The diagram below (not drawn to scale) shows the diagram of a medal plaque. The plaque consists of a circle with center  $O$ , a uniform circular ring with center  $B$  and triangle  $OFG$ .  $OD$  is the height of the triangle  $OFG$ .

$AOE = 16$  cm,  $BC = 2$  cm,  $DF = DG = 6.61$  cm and  $DE = 3.5$  cm.



- (a) Show that  $OD$  is 4.5 cm.

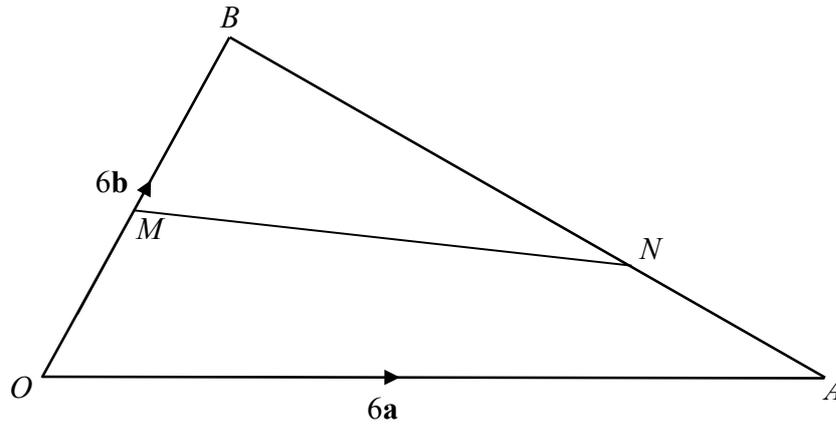
*Answer*

[1]

- (b) The shaded region will be painted with gold paint which cost \$2.00 per  $\text{cm}^2$ .  
The un-shaded region will be painted with silver paint which cost \$1.20 per  $\text{cm}^2$ .  
Find the cost of painting of the plaque.

Answer (b) \$..... [5]

22 In the diagram,  $\overrightarrow{OA} = 6\mathbf{a}$ ,  $\overrightarrow{OB} = 6\mathbf{b}$  and  $3\overrightarrow{AN} = \overrightarrow{AB}$ .  $M$  is the mid-point of  $OB$ .



(a) Express  $\overrightarrow{AN}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$  in its simplest form.

Answer (a) ..... [2]

(b) Express  $\overrightarrow{ON}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$  in its simplest form.

Answer (b) ..... [1]

(c) Hence, or otherwise, show that  $\overrightarrow{NM} = \mathbf{b} - 4\mathbf{a}$ .

Answer

[2]

(d)  $P$  is a point, not shown on the diagram, such that  $\overrightarrow{MP} = 3\overrightarrow{MN}$ .

(i) Find the position vector of  $P$ .

*Answer* (d)(i)..... [2]

(ii) Write down 2 facts about the points  $O$ ,  $A$  and  $P$ .

*Answer* .....  
.....  
..... [2]

**End of Paper**