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JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
Secondary 4 Express/ 5 Normal Academic

STUDENT NAME

CLASS

INDEX NUMBER

MATHEMATICS

4052/01

Paper 1

1 August 2024

2 hours 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces on all the work you hand in.
Write in dark blue or black pen.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO NOT WRITE ON ANY BARCODES.

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

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 total marks for this paper is 90.

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 π, use either your calculator value or 3.142.

DO NOT OPEN THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

For Examiner's Use
90

Mathematical Formulae

Compound interest

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

Mensuration

Curved Surface area of a cone = πrl

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

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

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

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

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ 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

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

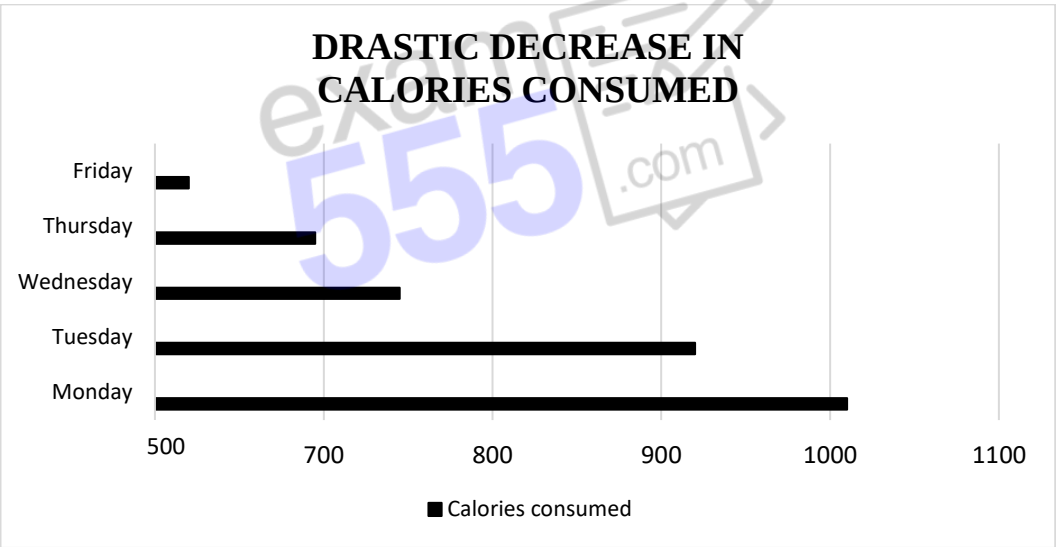
Standard deviation = $\sqrt{\frac{\sum fx^2}{\sum f}-\left(\frac{\sum fx}{\sum f}\right)^2}$

Answer ALL the questions.

1 Solve $\frac{x-3}{x+4}=\frac{2}{3}$.

Answer ……... [1]

2 Ronald drew the following graph to show the number of calories he consumed for lunch in a working week.



State one aspect of the graph that may be misleading and explain how this may lead to a misinterpretation of the graph.

……..……...……...……...…

……..……...……...……...…

……..……...……...…… [2]

3 **(a)** Express 546 as a product of its prime factors.

Answer ……... [1]

(b) The lowest common multiple of 14, 26 and p is 546.

Find two possible values of p which are odd.

Answer ……... [2]

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4 Jayden bought a box of pencils for 90 cents.
When he sold it, he made a profit of 200% of his cost.

Calculate his selling price.

Answer $……... [2]

---

5 Factorise fully $6w^2 + 3wx - 8pw - 4px$.

Answer ……... [2]

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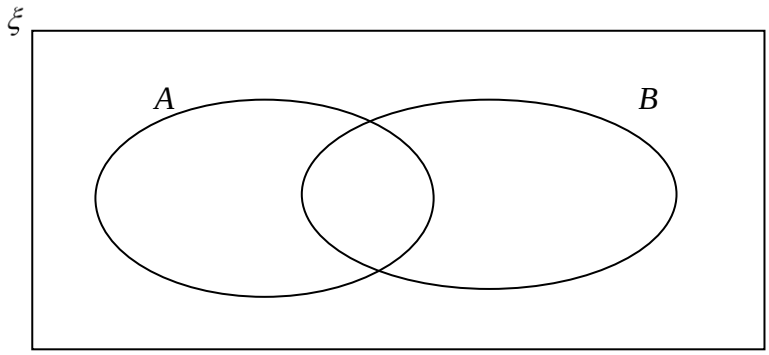
6 It is given that

$\xi = \{x : x \text{ is an integer and } 1 \leq x < 15\}$
$A = \{x : x \text{ is a multiple of } 3\}$
$B = \{x : x \text{ is a prime number}\}$

(a) Illustrate the information in the following Venn diagram.



[2]

(b) List the elements of $A' \cap B$.

……..……..……..……..……..……..…

……..……..……..……..……..…… [1]

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7 **(a)** Simplify $\frac{a^m \times (2a)^3}{16a^0}$, giving your answer in the form of $k\,a^n$, where k is a constant.

Answer ……... [1]

(b) Given that $7^{35} \div 2401^{-1} = 49^p$, find the value of p.

Answer ……... [2]

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8 The sum of the interior angles of a regular polygon is eight times that of an octagon.

(a) Find the number of sides of the regular polygon,

Answer ……... [2]

(b) Find an exterior angle of the regular polygon.

Answer ……... [1]

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9 A six-faced die was thrown 28 times. The table shows the number of times that each possible score occurred.

Score	1	2	3	4	5	6
Frequency	8	6	6	2	4	2

The die was thrown 2 more times.
Amanda calculated the mean score of all the 30 times mentally and gave the answer as 3.1.
Is Amanda's calculation correct? State your reasons clearly.

Answer:

Therefore, Amanda's calculation is <u>* correct / incorrect</u> since

……

……...……... [3]

*Delete whichever is inappropriate.

10 When n is a positive integer, $(2n + 3)$ is an odd number.

(a) Write down an expression, in term of n, for the next consecutive odd number.

Answer ……... [1]

(b) Find and simplify an expression, in terms of n, for the difference between the squares of these two odd numbers.

Answer ……... [2]

(c) Hence explain why the difference between the squares of two consecutive odd numbers is always a multiple of 8.

……

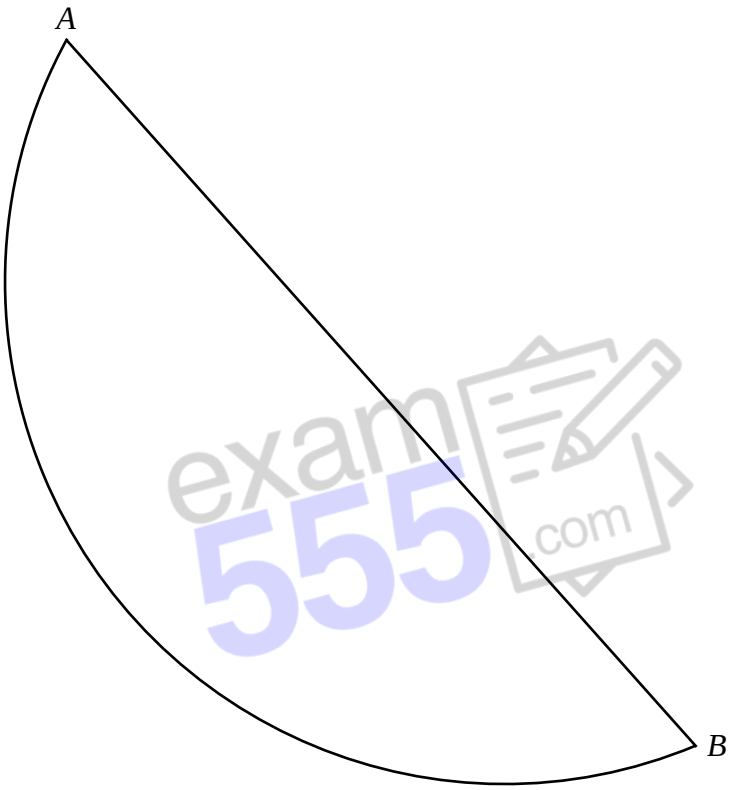
……

…… [1]

11 The diagram below shows a segment of a circle. AB = 12.5 cm.

(a) Find the centre of the circle by construction and mark it with a letter O. [3]

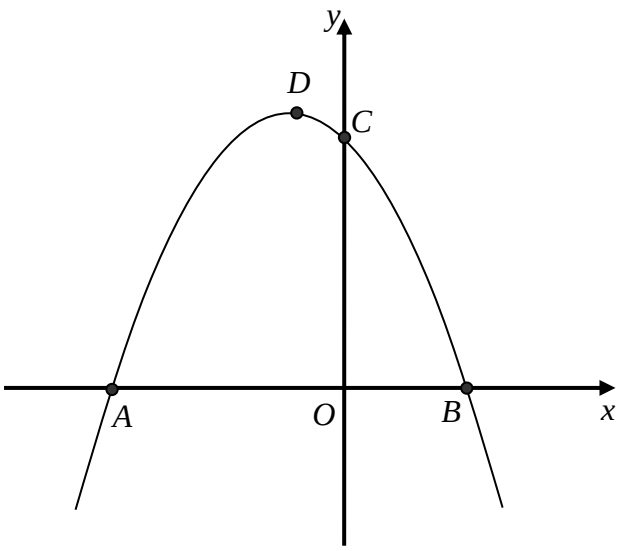
Answer



(b) Find the radius of the circle.

Answer ……... cm [1]

12 In the diagram below, the coordinates of A, B and C are $(-4, 0)$, $(2, 0)$ and $(0, 8)$ respectively.



(a) Find the equation of the curve.

Answer ……... [2]

(b) Find the coordinates of D, the maximum point of the curve.

Answer D = (……,…….) [2]

13 Study the pattern of numbers below.

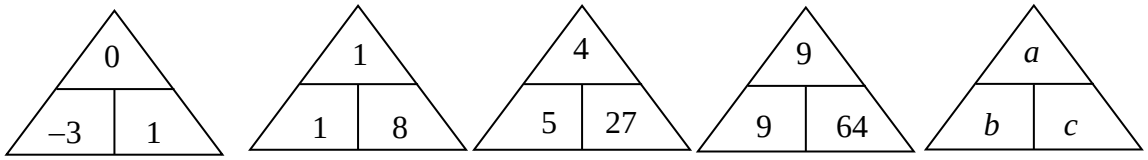


Figure 1 Figure 2 Figure 3 Figure 4 …… Figure *n*

Find the values of *a*, *b* and *c* if $n = 6$.

Answer a =…… b = ……c = …….. [3]

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14 Given the coordinates of two points A and B are $(13, -5)$ and $(9, 2)$ respectively and point C is such that $\overrightarrow{AC} = \begin{pmatrix} m \\ 21 \end{pmatrix}$, find

(a) $\left|\overrightarrow{AB}\right|$,

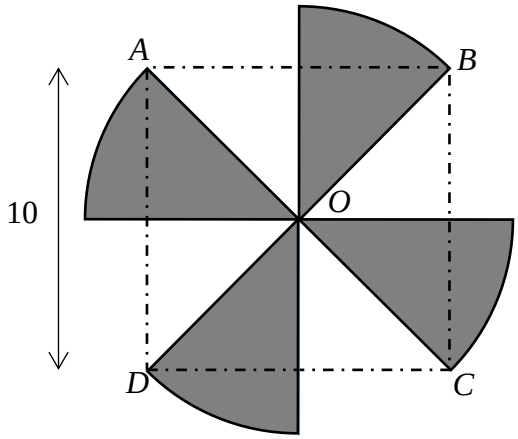
Answer …….. [2]

(b) the value of *m* if *A*, *B* and *C* are collinear.

Answer …….. [2]

15 The shaded figure is made of four equal sectors with centre O.

$ABCD$ is a square with sides 10 cm.
Calculate the area of the shaded figure.



Answer ..... [3]

16 Solve the simultaneous equations.

$$4x - y - 16 = 0$$
$$\frac{3}{4}x + \frac{1}{2}y = 0.25$$

Answer $x =$ ..... $y =$ ..... [3]

17 The kinetic energy, E Joules, of an object is directly proportional to $(v+0.5)^2$, where v is the velocity in m/s.

Given that the difference between the values of E when $v=10$ and when $v=13$ is 1296 Joules, express E in terms of v and hence, find the value of E when $v=20$.

Answer ……..…….... [3]

18 The diameter of a motorcycle wheel is 52.9 cm.

When the motorcycle travels at a constant speed of 90 km/h, find the number of revolutions made by the wheel per minute, giving your answer to the nearest whole number.

Answer ..…….... [3]

19 A map is drawn to a scale of 1 : 300 000.

(a) The length of a bridge measures 5.2 km.
Calculate the length of the bridge on the map in centimetres.

Answer ……...cm [1]

(b) The area of a forest measures 7.5 cm^2 on the map.
Find the actual area of the forest in square kilometres.

Answer ……...km^2 [2]

20 The masses, in kilograms, of bags of tomatoes in a shipment are shown in the stem-and-leaf diagram below.

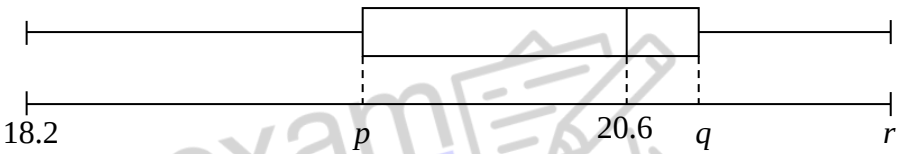
Stem	Leaf
18	2 4 7
19	0 2 5 7 8 8 9
20	1 2 5 6 6 6 7 9 9
21	3 5 5 5 7 8 8 9

Key: 18 | 2 represents 18.2 kg

(a) Find the number of bags of tomatoes in the shipment.

Answer ……... [1]

(b) The data above can be represented by a box-and-whisker diagram as shown below. Given that the mass of the lightest bag is 18.2 kg, find the value of p, q and r.



Answer p = ……, q = …… , r = …… [3]

21 **(a)** Solve the equation $2 - \frac{3t - 1}{2t + 5} = 1$.

Answer ……... [2]

(b) **(i)** Factorise completely $27n^3 - 3n$.

Answer ……... [2]

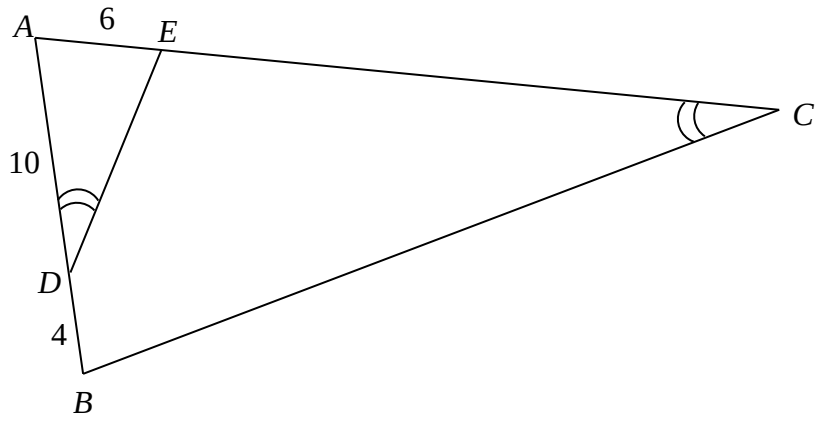
(ii) Explain why $27n^3 - 3n$ is divisible by 2 for any integer value of n.

……

……

…..……[1]

22



In the diagram, $\angle ACB = \angle ADE$.

(a) Explain why triangles ABC and AED are similar.

……

……

…… [2]

(b) Given also that $AE = 6$ cm , $AD = 10$ cm and $DB = 4$ cm , calculate

(i) CE,

Answer ……... [2]

(ii) $\dfrac{\text{Area of triangle } ABC}{\text{Area of triangle } AED}$.

Answer ……... [1]

23 The diagram shows a grid of squares.

S	***Q***	***U***	***A***	***R***	***E***

A button is first placed on square *U*.
A fair 6-sided die is then thrown.
If 1, 2, 3 or 4 is thrown, the button is moved one square to the left.
If 5 or 6 is thrown, the button is moved two squares to the right.
The button cannot move off the grid.
If a move cannot be made according to the rules, the button remains unmoved.

(a) The die is thrown twice and the button is moved accordingly.
Find the probability that the button finishes at

(i) *S*,

Answer ..... [1]

(ii) *A*.

Answer ..... [2]

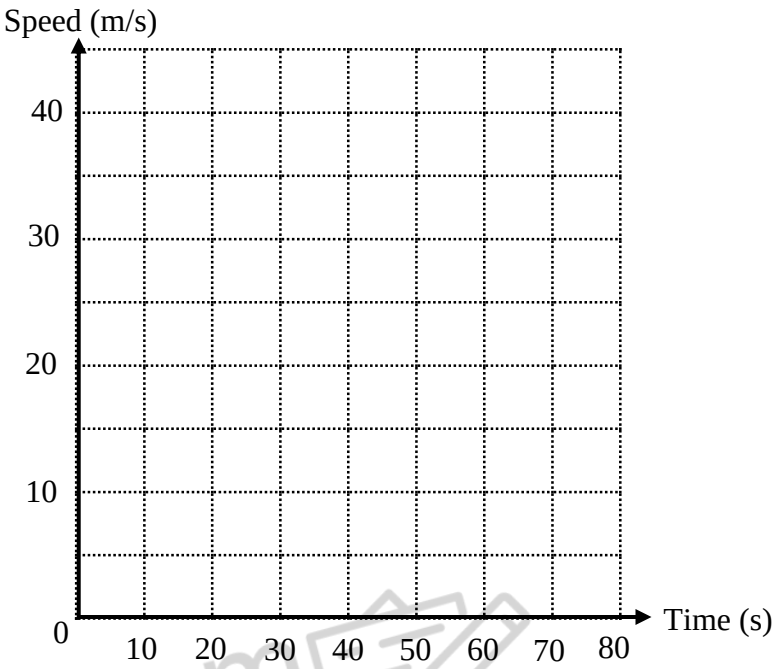
(b) If the die is thrown thrice and the button is moved accordingly, find the probability that the button returns back to its original position.

Answer ..... [2]

24 A train travels at a constant speed of 40 m/s for 50 seconds.
It then slows down at a constant rate until it comes at rest in 20 seconds.

(a) On the axes, draw the speed-time graph for the journey.

Answer



[1]

(b) Calculate the distance travelled by the train during the first 60 seconds.

Answer …… m [2]

25 The table below shows the number of cups of Banana and Mango-flavoured smoothies, sold at three different shops in November and December.

	Selling Price ($)	**November**		**December**	
		Banana	**Mango**	**Banana**	**Mango**
Shop *A*	3.50	270	380	330	455
Shop *B*	4.20	150	230	195	310
Shop *C*	4.00	260	250	220	290

The information for the selling price of the smoothies in the three shops can be represented by the matrix $\mathbf{P} = (3.5 \quad 4.2 \quad 4)$.

The information for the number of cups of smoothies sold in November can be represented by the matrix $\mathbf{N} = \begin{pmatrix} 270 & 380 \\ 150 & 230 \\ 260 & 250 \end{pmatrix}$.

(a) Write down a 3×2 matrix **D** to represent the number of cups of smoothies sold in December.

Answer **D** = ……... [1]

(b) Given that $\mathbf{X} = \mathbf{N} + \mathbf{D}$ and $\mathbf{Y} = \mathbf{PX}$, evaluate **Y** and explain what the elements in **Y** represent.

Answer **Y** = ……... [2]

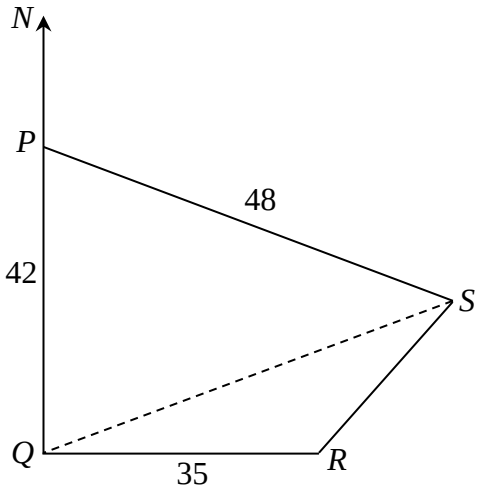
Y represents ……

…… [1]

(c) Write down a matrix **Z** such that its product with **Y** gives the total amount of sales for the three shops. Hence, evaluate the product by matrix multiplication.

Answer **Z** = ……... [2]

26



The diagram below shows a field, *PQRS*.
P, *Q*, *R* and *S* are on level ground such that *R* is due east of *Q*.
The bearing of *S* from *P* is 105°.
QS is a straight path across the field.
PQ = 42 m, *PS* = 48 m, *QR* = 35 m.
Calculate the area of the field *PQRS*.

Answer …… m^2 [6]

End of Paper