NAME: _____ ( ) CLASS: _____

FAIRFIELD METHODIST SCHOOL (SECONDARY)

PRELIMINARY EXAMINATION 2024
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

MATHEMATICS 4052/01

Paper 1

Date: 19 August 2024 **Duration: 2 hours 15 minutes**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

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 of the 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.

For Examiner's Use

Table of Penalties		**Question Number**		
Presentation	☐ 1 ☐ 2			**90**
Rounding off	☐ 1		Parent's/Guardian's Signature	

Setter: Mr Alester Tan

This question paper consists of 23 printed pages

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NAME: _____ **( )** **CLASS:** _____

Mathematical Formulae

Compound interest

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

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

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NAME: _____ **( )** **CLASS:** _____

Answer **all** the questions.

1 Given that $p : 16 = 3 : 20$, find the value of p.

Answer $p =$..... [1]

---

2 **(a)** Factorise completely $2a^2c - ad - 2abc + bd$.

Answer ..... [2]

(b) Expand and simplify $(7x - 4y)(x + 3y)$.

Answer ..... [2]

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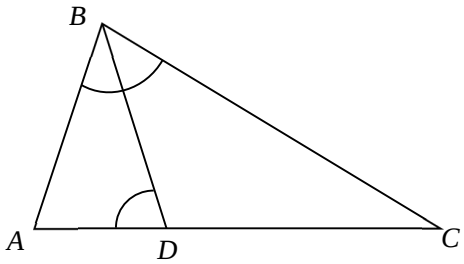
3 Tristen has written five positive integers.
The median of these numbers is 8, the mode is 7 and the mean is 13.
The range of these numbers is 21.

Find the five numbers.

Answer .... [2]

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4 In the diagram, ABC is a triangle. D is the point on AC such that $\angle ABC = \angle ADB$.



(a) Show that triangles ABC and ADB are similar.
Answer

……...……

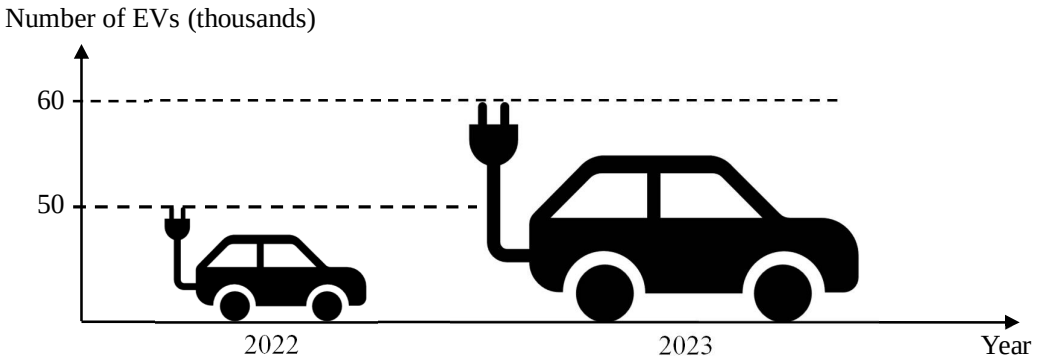
...……....[2]

(b) Given that AB = 8 m and AD = 5 m, find AC.

Answer ……m [1]

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5 The graph shows the number of electric vehicles (EVs) manufactured by a company for the years 2022 and 2023.



Explain how the graph above may be misleading.

Answer

……

...…….. [1]

---

6 A map has a scale of 1 : 2 000 000.
The area of Johor Bahru on the map is 0.55 cm^2.
Calculate the actual area, in square kilometres of Johor Bahru.

Answer ……km^2 [2]

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7 In a sequence, the same number is added each time to obtain the next term.
The second term of the sequence is 11 and the fifth term of the sequence is 32.

(a) Write an expression in terms of n, for the nth term of the sequence.

Answer …… [1]

(b) Explain why 121 is not a term in the sequence.

Answer

……

……. [1]

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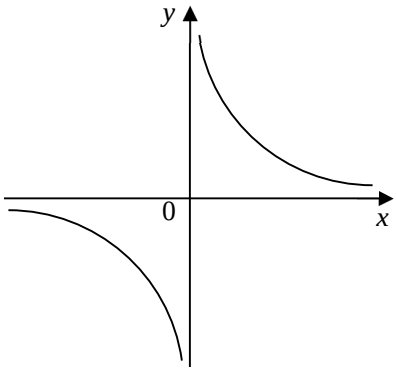
8 The force, F, between two particles is inversely proportional to the square of the distance, d, between them.

Calculate the percentage change in force when the distance between the two particles is increased by 350%.

Answer …… % [2]

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9 **(a)** The sketch represents the graph of $y = x^n$. Write down a possible value of n.

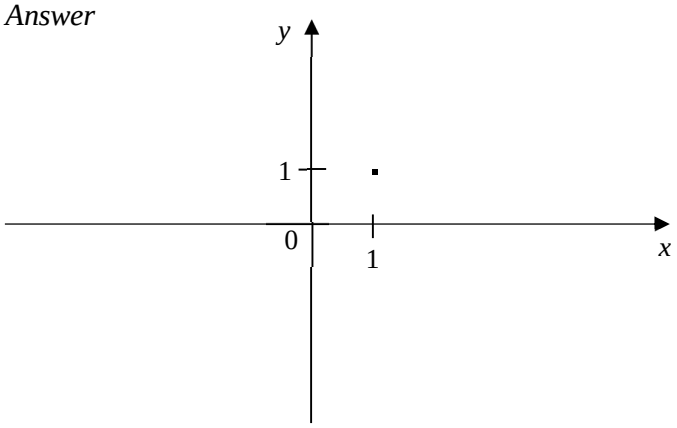


Answer n = ……. [1]

(b) The point (1, 1) is marked on each diagram below.
On these diagrams, sketch the graphs of

(i) $y = 2x + 1$,

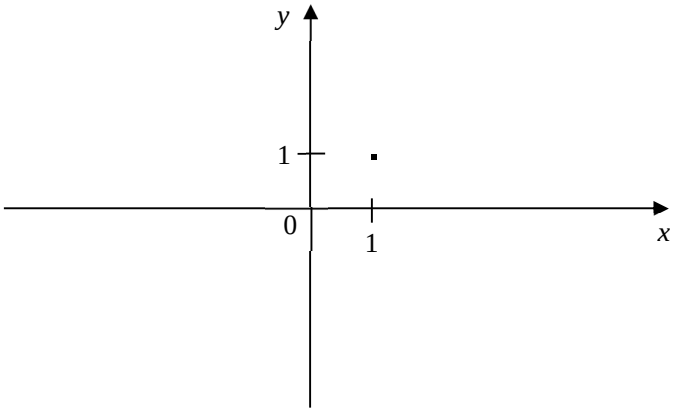
Answer



[1]

(ii) $y = \frac{2}{x^2}$.

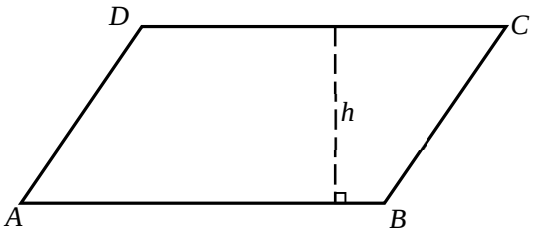
Answer



[1]

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10 The diagram shows a parallelogram *ABCD*. The perpendicular height is *h* cm.



The area of parallelogram is increased by 150% when *AB* is reduced by 20% and *h* is increased by *x* %. Find the value of *x*.

Answer x = …… [2]

---

11 The frequency table shows the Mathematics quiz marks of 25 students. The mean marks is 13.8.

Marks	12	13	14	15	16
Number of students	5	5	7	6	2

(a) Find the standard deviation of the marks.

Answer …..…… [2]

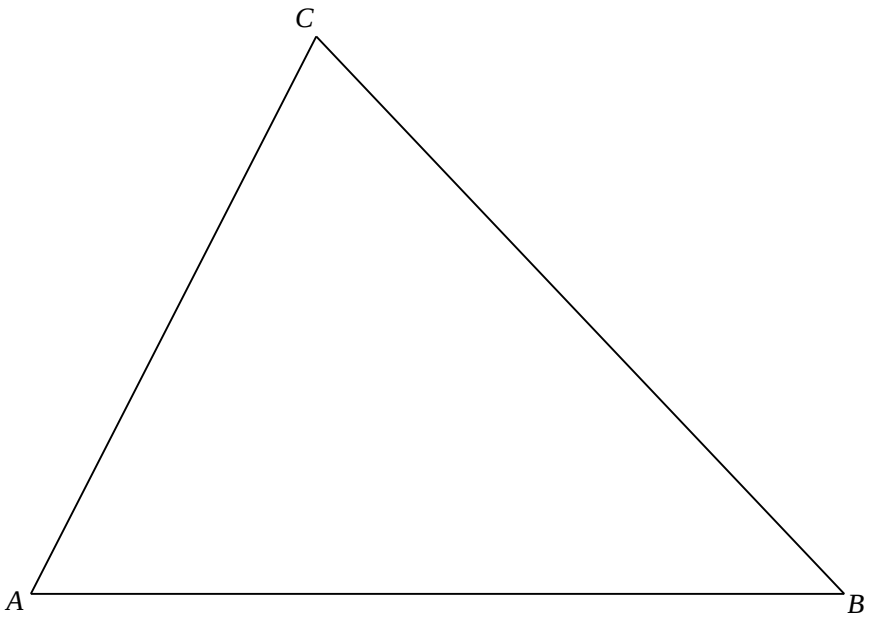
(b) It was discovered that there was a mistake in the recording of the quiz marks. The correct mark for each student was 3 more than the recorded mark.
A student commented that the spread of the quiz marks in the class is now wider after the addition of marks.
Explain why his comment is wrong using mean and standard deviation of the marks.
Answer

……

...…….. [1]

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12 Three points *A*, *B* and *C* are shown below.



(a) Construct the perpendicular bisector of *BC*. [1]

(b) Construct the angle bisector of angle *ACB*. [1]

(c) These two bisectors meet at *P*.
Complete the statement below.
Answer

The point *P* is equidistant from the lines …… and ……

and equidistant from the points …… and …… . [1]

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13 **(a)** Use prime factors to explain why 54×150 is a perfect square.

Answer

……

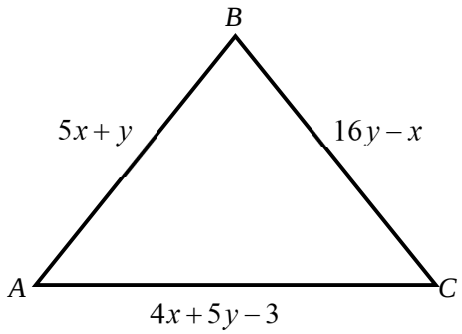
...…….. [2]

(b) The number $150k$ is a perfect cube.
Find the smallest possible integer value of k.

Answer k =…… [1]

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14 ABC is an equilateral triangle with lengths $(5x+y)$ cm, $(16y-x)$ cm and $(4x+5y-3)$ cm.



(a) Write down two simultaneous equations, in terms of x and y, to represent this information.

Answer ……..

……. [2]

(b) Solve the simultaneous equations and hence find the area of triangle ABC.

Answer ……. cm^2 [4]

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15 **(a)** Given that $\frac{4^{\frac{1}{2}}}{16^{y+1}} = 8^{2-y}$, find the value of y.

Answer y = …… [3]

(b) Jasmine says that 2^{500} is greater than 5^{250}. Do you agree with her statement? Justify your answer with mathematical working.

Answer

……

……

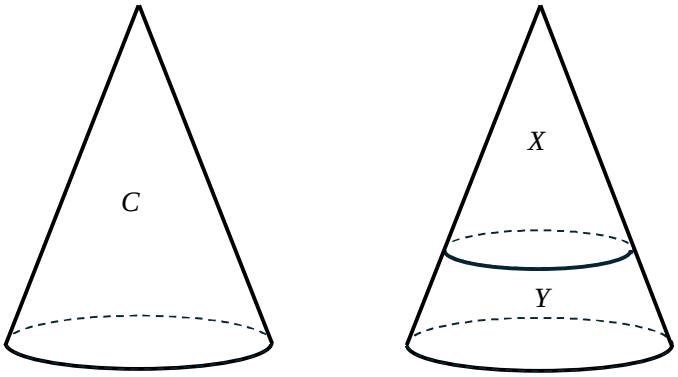
……

……

...……[2]

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16



A solid cone, C is cut into two parts, X and Y, by a plane parallel to the base.
The ratio of the areas of the bases of X and C is 25 : 49.

(a) Find the ratio of the circumference of the bases of X and C.

Answer …… : …… [1]

(b) The mass of C is 36 kg. Find the mass of Y.

Answer ……kg [2]

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17 **(a)** **(i)** The expression $x^2 - 12x + 5$ is equivalent to $(x-a)^2 + b$.

Find the value of *a* and the value of *b*.

Answer a =……..

b =…… [2]

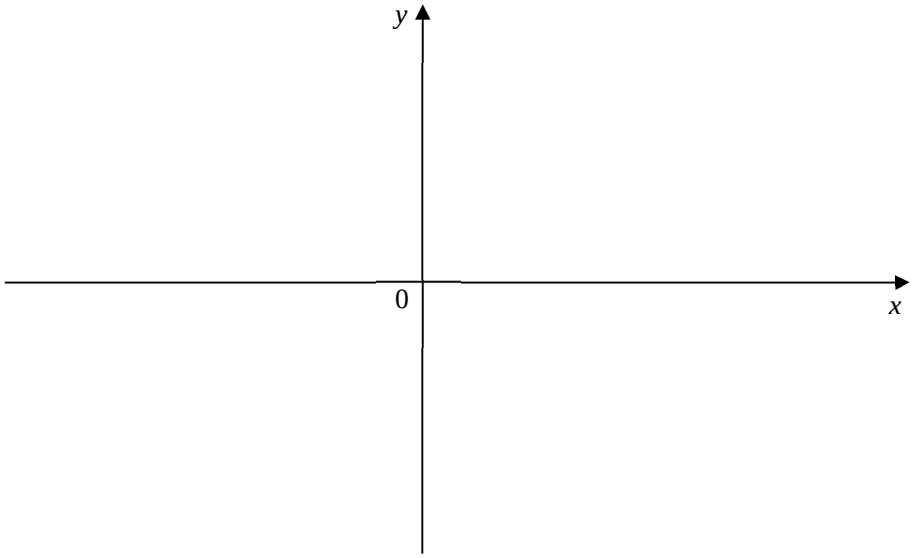
(ii) The curve $y = x^2 - 12x + 5$ is drawn.

Write the equation of the line of symmetry of the curve.

Answer …… [1]

(b) **(i)** Sketch the graph of $y = -(x-3)(x+5)$ on the axes below.

Indicate clearly the values where the graph crosses the *x*- and *y*-axes.



[2]

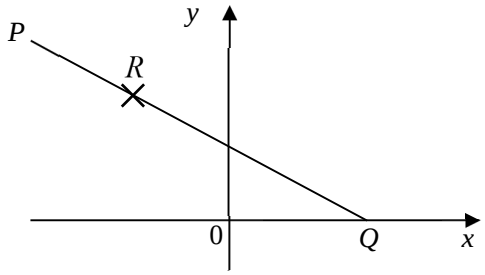
(ii) State the coordinates of the maximum point of the graph of $y = -(x-3)(x+5)$.

Answer (…… , ……) [1]

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18 In the diagram, $R(-3, 4)$ is on PQ such that the midpoint of RQ lies on the y-axis.

Point Q lies on the x-axis.



(a) Find the coordinates of Q.

Answer Q(…… , ……) [1]

(b) Given that the point P has coordinates $(x, 6)$, find the value of x.

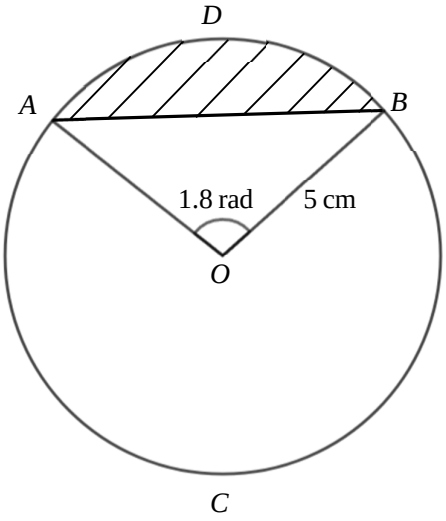
Answer x = …… [2]

(c) Find the equation of the line PQ.

Answer ……..…… [1]

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19 A, B, C and D lie on a circle with centre O and radius 5 cm. $\angle AOB = 1.8$ radians.



(a) **(i)** Write down an expression, in terms of π, for the reflex angle AOB.

Answer ……rad [1]

(ii) Find an expression, in terms of π, for the length of the arc ACB.

Answer ……cm [1]

(b) Find the area of the shaded segment ADB.

Answer ……cm^2 [3]

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20 **(a)** $\xi = \{\text{integers } x : 1 \le x \le 18\}$

$A = \{1, 4, 9, 16\}$

$B = \{\text{integers that are divisible by 2}\}$

(i) Describe the elements of set A.

Answer

.....[1]

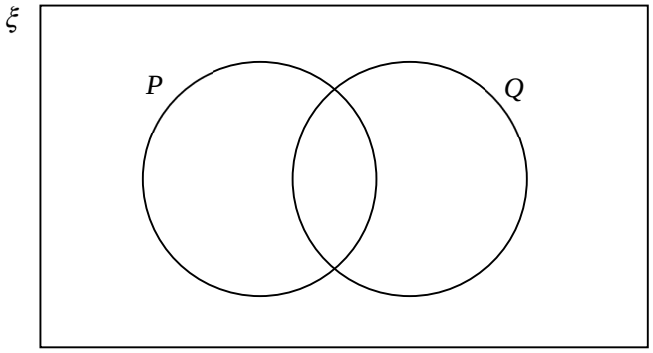
(ii) List the elements contained in the set $A \cap B'$,

Answer ..... [1]

(iii) Write down the number of elements contained in the set $A \cup B$.

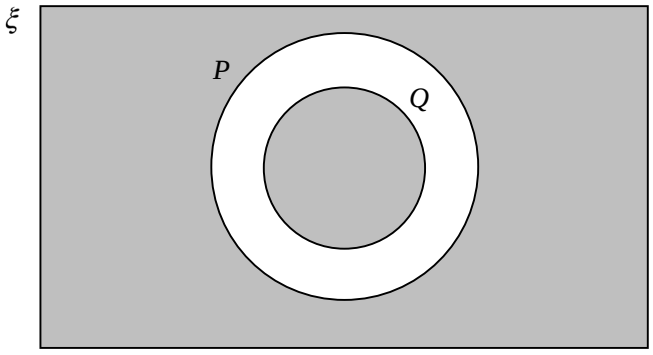
Answer ..... [1]

(b) **(i)** On the Venn diagram, shade the region which represents $(P \cup Q)'$.



[1]

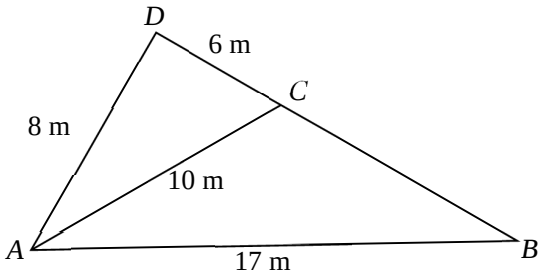
(ii) Using set notation to describe the shaded region.



Answer ..... [1]

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21 **(a)** In the diagram below, DCB is a straight line.
$AD = 8$ m, $AC = 10$ m, $CD = 6$ m and $AB = 17$ m.



(i) Show that $\angle ADC$ is a right angle.
Answer

……

...…... [2]

(ii) Express the value of $\cos \angle ACB$ as a fraction in its lowest term.

Answer …… [1]

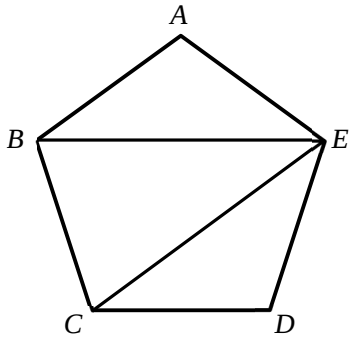
(b) $\sin x° = 0.8929$

Find two possible values of x in the range $0° \leq x \leq 180°$.

Answer x = ……. or …… [2]

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22 In the diagram, *ABCDE* is a regular pentagon.



(a) Calculate

(i) $\angle BAE$,

Answer ……° [1]

(ii) $\angle AEB$,

Answer ……° [1]

(iii) $\angle BEC$.

Answer ……° [1]

(b) Explain why *BE* is parallel to *CD*.

Answer

…..…..……..

……..……..…..

..…… [1]

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23 The stem-and-leaf diagram below shows the times, in minutes, taken by 15 students to complete a task.

Stem	Leaf						
1	5	6	8	9	9		
2	0	2	4	*p*	5	5	7
3	0	0	2				

Key: 1 | 5 represents 15 minutes

(a) The modal time is 25 minutes. Find the value of p.

Answer p = …… [1]

(b) Find the interquartile range.

Answer …… minutes [2]

(c) When the time taken for the 16^{th} student is added to the diagram, the median is 23 minutes. What is the possible time taken by this student to complete a task?

Answer …… minutes [1]

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24 There are 30 blue balls, 20 green balls and 14 yellow balls in a bag.
A ball is chosen at random from the bag and then replaced.

(i) Find the probability of not picking a green ball, express your answer to the lowest term.

Answer …… [1]

(ii) The probability of picking a green ball from the bag after x number of green balls are removed is $\frac{3}{14}$. Using algebra, find the value of x.

Answer x = …… [2]

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25 Two outlets of a coffee chain sell three different types of coffee: espresso, flat white and mocha. The table shows the number of cups of each type of coffee sold on a particular day.

Outlet	Expresso	Flat White	Mocha
A	30	30	35
B	x	$x + 2$	40

This information can be represented by the matrix $\mathbf{P} = \begin{pmatrix} 30 & 30 & 35 \\ x & x+2 & 40 \end{pmatrix}$.

The coffee chain sells a cup of espresso at \$2.50, a cup of flat white at \$4 and a cup of mocha at \$5.50.

This information can be represented by the matrix $\mathbf{Q} = \begin{pmatrix} 2.5 \\ 4 \\ 5.5 \end{pmatrix}$.

(a) Find, in terms of x, the matrix $\mathbf{R} = \mathbf{PQ}$.

Answer $\mathbf{R}$ = …… [1]

(b) Explain what the elements of the first row of matrix **R** represent.

Answer

……

…… [1]

(c) Outlet *B* collected \$100.50 more than Outlet *A* from the sales of coffee on that particular day. Find x.

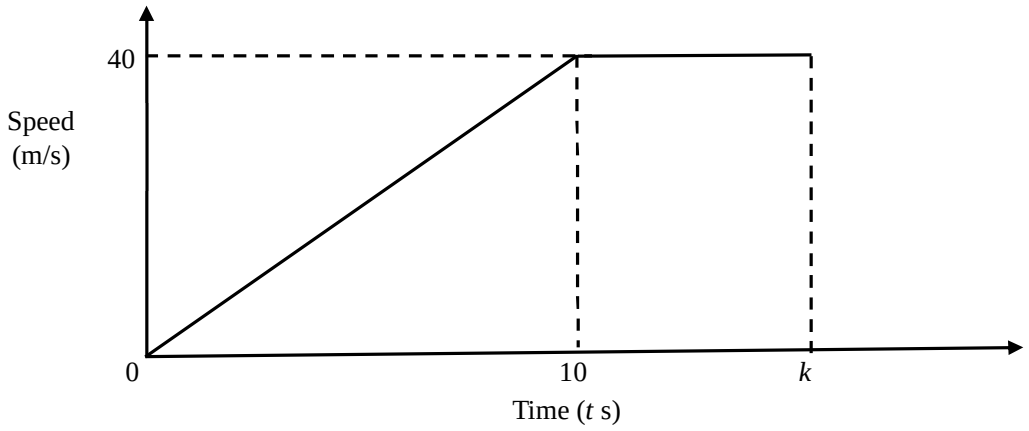
Answer x = …… [1]

(d) The elements of matrix **T**, where **T** = **SR**, represents the total amount of money, in dollars, collected in outlets *A* and *B* on that particular day. Write down the matrix **S**.

Answer **S** = …… [1]

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26 The diagram is the speed-time graph for the first k seconds of the motion of an object.



(a) Find the acceleration when $t = 5$.

Answer …….. m/s^2 [1]

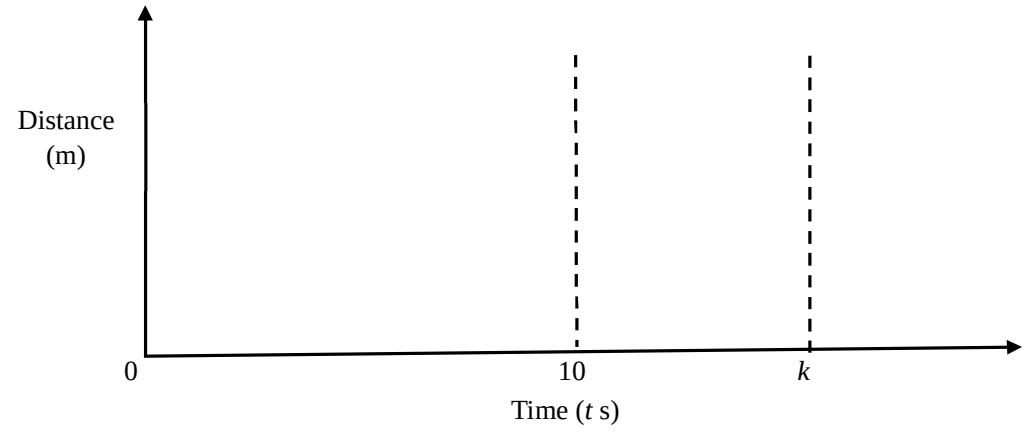
(b) Find the distance travelled in the first 10 seconds.

Answer ……m [1]

(c) The distance travelled in the first k seconds is 520 m. Find the value of k.

Answer k = …….. [1]

(d) On the axes in the answer space, sketch the distance-time graph for the first k seconds of the motion of the object.



[2]

~ End of Paper ~

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