NAME:		( )
CLASS:	TEACHING GROUP:	MARKS /80

PEI HWA SECONDARY SCHOOL

MID YEAR EXAMINATION 2022

Secondary Four Express/ Five Normal (Academic)

MATHEMATICS

4048/01

Paper 1

9 May 2022

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, teaching group, index number and name 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.
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. Gives answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

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	
Category	**Question No.**
Correction tape	
Pencil written	
Arrows	
Units	
Others	

This document consists of **16** printed pages.

Mathematical Formulae

Compound Interest

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

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

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

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

Answer **all** the questions.

1 (a) Solve $5x = 12 + \frac{x}{3}$.

Answer $x =$ ..... [1]

(b) Simplify $7m - 2n - 3(n - 2m)$.

Answer..... [2]

2 Write as a single fraction in its simplest form $\frac{3}{2}x - \frac{5(x-3)}{6}$.

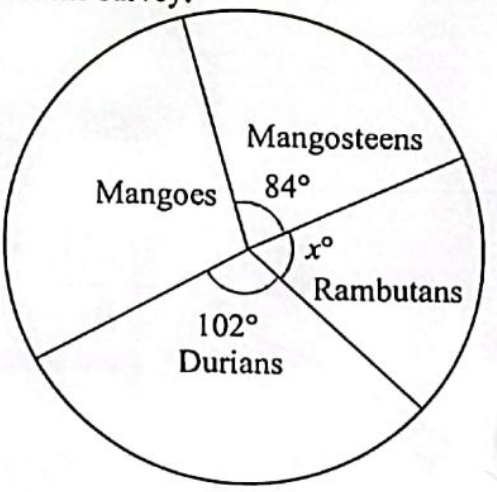
Answer..... [2]

3 Factorise completely $10x^2 - y + 5xy - 2x$.

Answer..... [2]

Answer x = ... or x = ... [3]

5 300 children were surveyed on their favourite tropical fruits.
The pie chart shows the results of the survey.



(a) 60 children like rambutans, find the value of x.

Answer x = ... [1]

(b) Find the ratio of the number of children who like rambutans to those who like mangoes.

Answer ..... [2]

(c) Express the number of children who likes durians as a percentage of the total number of students surveyed.

Answer ..... % [1]

6 Written as a product of its prime factors, $270 = 2 \times 3^3 \times 5$.

(a) Express 198 as the product of its prime factors.

Answer ..... [1]

(b) Write down the greatest positive integer that will divide both 198 and 270 exactly.

Answer ..... [1]

7 Written as a product of its prime factors, $400 = 2^4 \times 5^2$.

The integer $\frac{400p}{q}$ is a perfect cube where p and q are prime numbers.

Find the value of p and of q.

Answer p = ...

q = ... [2]

8 The cash price of a tablet is \$1455.
The hire-purchase of the tablet is \$1587.
The hire-purchase price is a deposit of 20% of the cash price plus 12 equal monthly payments.

Calculate the monthly payment.

Answer \$..... [2]

9 The following integers are in order such that $k \neq m$.

1, 1, 1, 1, 2, k, m, 6, 9, 9

The median is 2.5 and the mean is 3.8.

(a) Find the value of k and of m.

Answer $k =$ .....

$m =$ ..... [2]

(b) Judy chooses an integer at random from the list.

The probability of choosing this integer is $\frac{2}{5}$.

Which integer does she choose?

Answer ..... [1]

10 Junjie bought a cap at 12% discount and received an additional voucher discount of $7.
He paid $15 for the cap.

What was the original price of the cap?

Answer $..... [2]

11 The formula for the force, F in Newtons (N), on a moving object is $F = ma$, where m is the mass in kg and a is the acceleration in m/s^2.
An object has mass 5.27 kg and acceleration 24.92 m/s^2.

(a) By rounding these numbers correct to 1 significant figure, find an estimate of the force on the object.
Show the numbers you use.

Answer ..... N [1]

(b) Without doing any further calculation, explain if the force is an overestimate or underestimate.

Answer .....

.....

..... [1]

12 Simplify $\left(\frac{4\sqrt[3]{x^5}}{x}\right)^{\frac{3}{2}}$.

Answer..... [3]

13 The number of sides of a regular polygon P is doubled to form another regular polygon Q.
The ratio interior angle of polygon P : interior angle of polygon Q = 7:8.

(a) Find the number of sides of polygon P.

Answer..... sides [3]

(b) Hence, find the exterior angle of polygon Q.

Answer..... [2]

14 The volume of cone A is 4 cm^3.

Find the volume of cone B with 1.5 times the radius and 6 times the height of cone A.

Answer ..... cm^3 [2]

15 The volume of water, V cm^3, flowing through a tube is directly proportional to the square of its cross-sectional radius, r cm.

The radius is increased by 20%, find the percentage increase in the volume.

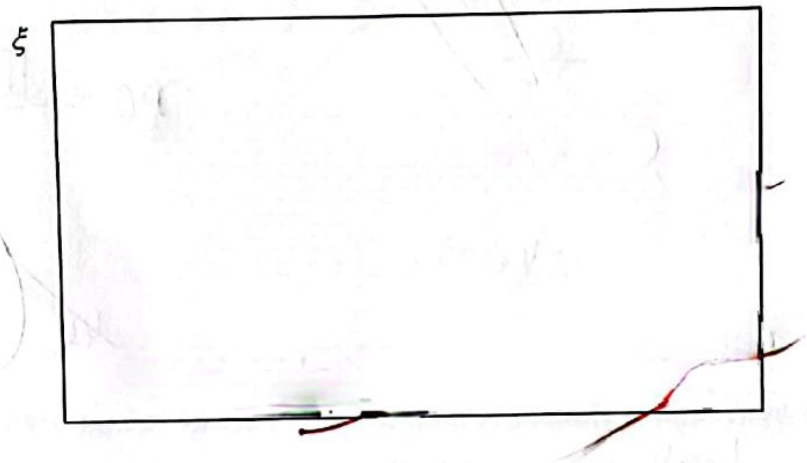
Answer ..... % [2]

16 $\xi = \{\text{integers } x: 12 < x < 24\}$

$A = \{x: 3x + 33 \leq 84\}$

$B = \{x: x \text{ is a prime number}\}$

(a) Draw a Venn diagram to illustrate this information.



[3]

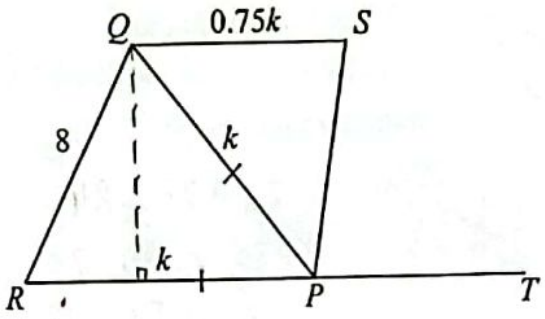
(b) List the elements contained in the set $A' \cap B'$.

Answer..... [1]

(c) Find the number of elements in $(A \cap B') \cup (A' \cap B)$.

Answer..... [1]

17 In the diagram, PQR is an isosceles triangle where $PQ = PR = k$ cm, $QS = 0.75k$ cm and $QR = 8$ cm. RPT is parallel to QS.



(a) Find $\sin \angle PRQ$ in terms of k.

Answer..... [2

(b) Given that the area of triangle QSP is 30 cm^2, find the area of triangle PRQ.

Answer ..... cm^2 [2]

18 (a) Express $x^2-10x+15$ in the form $(x+h)^2+k$.

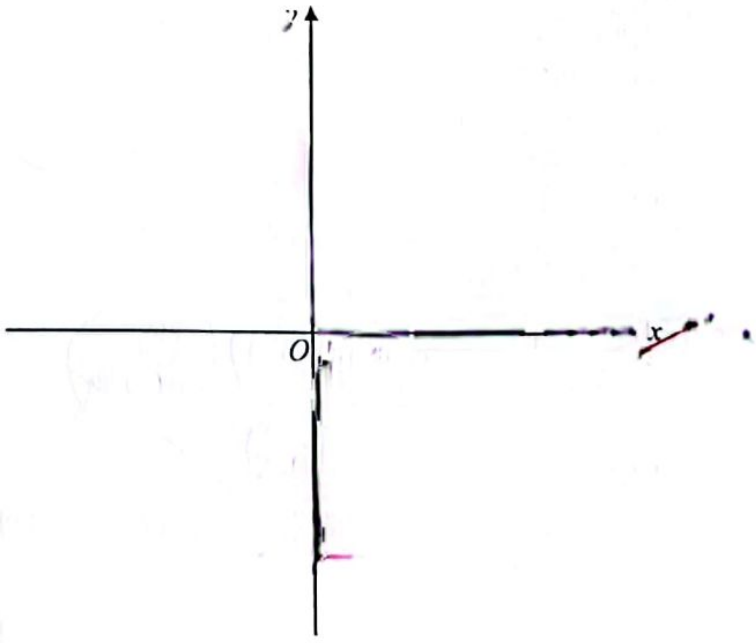
Answer ..... [2]

(b) Hence, solve the equation $x^2-10x+15=0$, giving your answers correct to two decimal places.

Answer $x =$ ..... or $x =$ ..... [2]

(c) Sketch the graph of $y=x^2-10x+15$ indicating clearly its intercepts with the axes and its turning point.

Answer



[3]

19 Patrick, Quincy and Rachel save $2, $5, $10 and $50 notes.

The number of notes that they save is given by the matrix **C**.

$$\mathbf{C} = \begin{array}{c} \begin{matrix} \$2 & \$5 & \$10 & \$50 \end{matrix} \\ \begin{pmatrix} 5 & 4 & 2 & 3 \\ 2 & 5 & 1 & 5 \\ 0 & 2 & x & 2 \end{pmatrix} \end{array} \begin{matrix} \\ \text{Patrick} \\ \text{Quincy} \\ \text{Rachel} \end{matrix}$$

(a) Given that $\mathbf{D} = \begin{pmatrix} 2 \\ 5 \\ 10 \\ 50 \end{pmatrix}$, find, in terms of x, the matrix $\mathbf{P} = \mathbf{CD}$.

Answer $\mathbf{P} =$ [2]

(b) Describe what is represented by the elements of **P**.

Answer .....

..... [1]

(c) Rachel saves the same amount as Patrick.

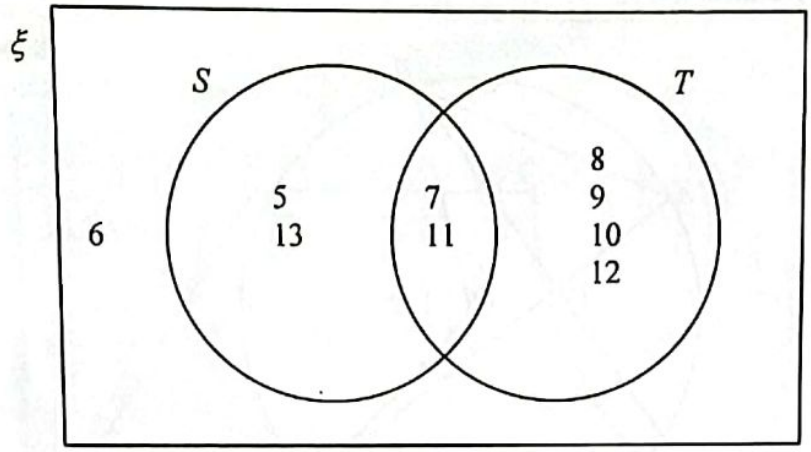
Find the value of x.

Answer $x =$ ..... [1]

(d) Using matrix multiplication, find the amount of money that Patrick, Quincy and Rachel save in total.

Answer $ ..... [2]

20 The Venn diagram shows two sets S and T. The elements are as shown.



(a) A number p is randomly chosen from ξ.

Find the probability that $p \in T'$.

Answer..... [1]

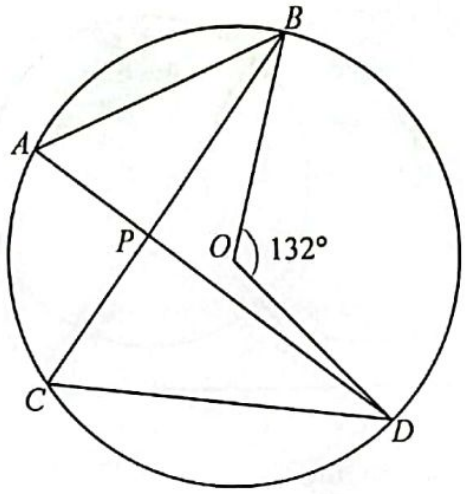
(b) Two numbers are randomly chosen from set S with replacement.

Find the probability that the sum of the two numbers is more than 20.

Answer..... [2]

21 In the diagram, O is the centre and angle BOD is 132°.

The chords AD and BC meet at P.



(a) Show that triangles PAB and PCD are similar.

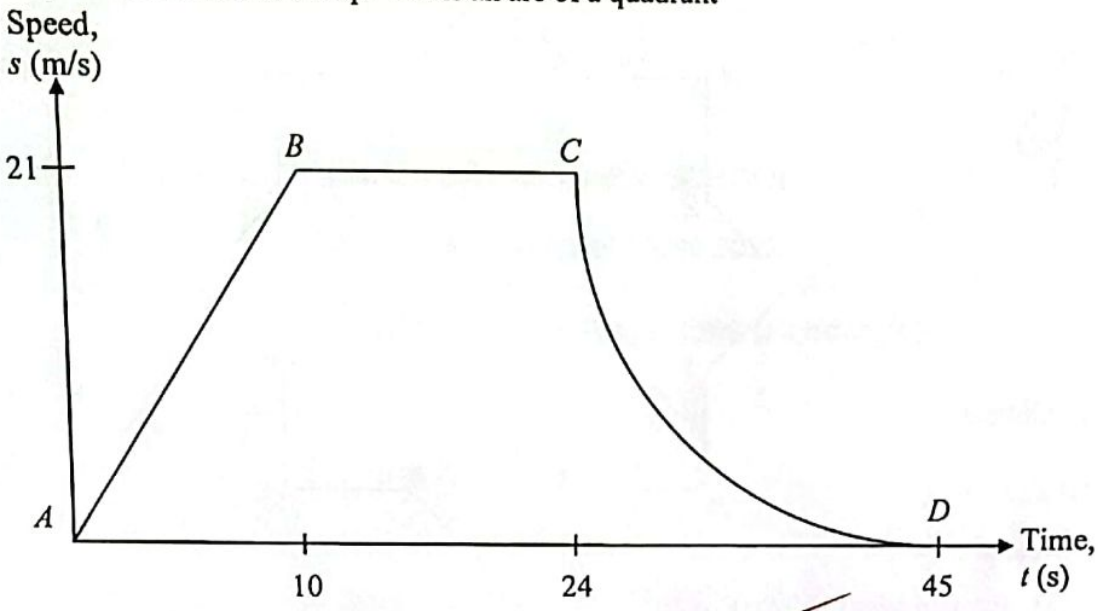
Answer

[2]

(b) Given that $AB = 6.9$ cm, $CD = 8.9$ cm and $PD = 10.6$ cm, find PB.
Give your answer to 1 decimal place.

Answer.....cm [2]

22 The diagram shows the speed-time graph of a train.
The train accelerates uniformly for 10 seconds and remained at a constant speed of 21 m/s before decelerating for 21 seconds to a stop. *CD* is an arc of a quadrant

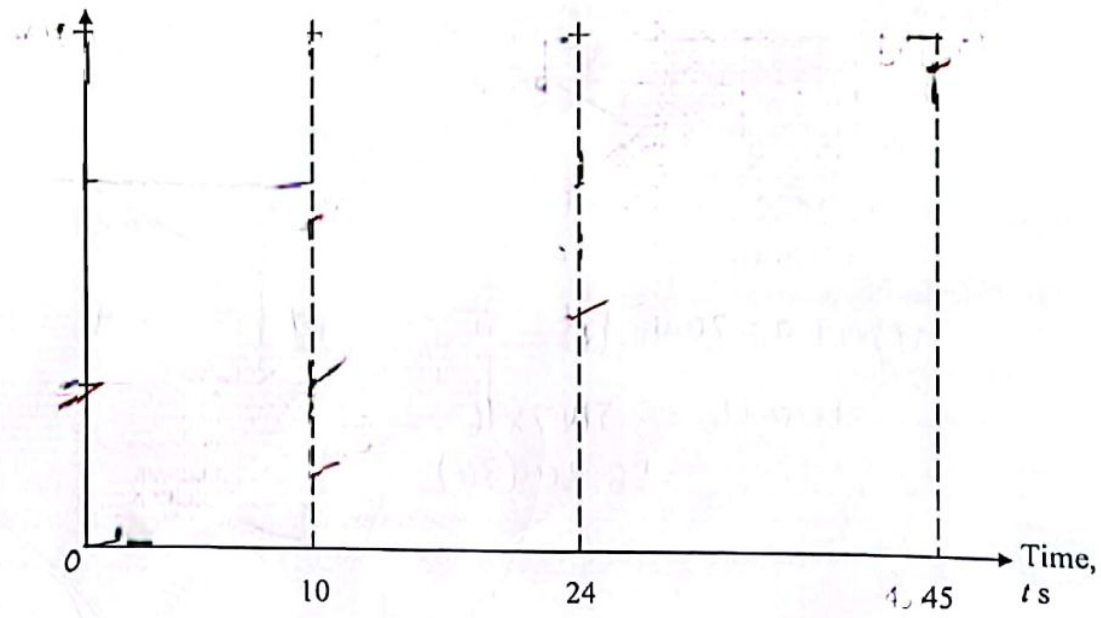


(a) Find the total distance travelled for the whole journey. Take $\pi = \frac{22}{7}$.

Answer ..... m [2]

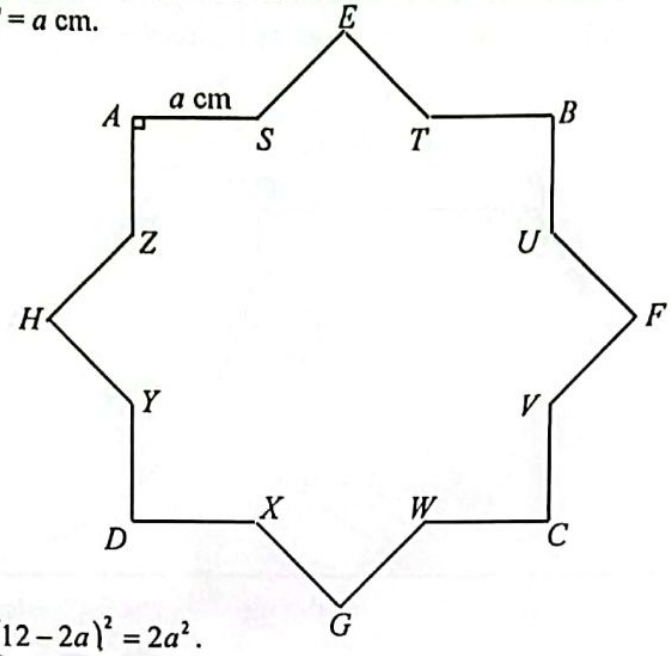
(b) Sketch the distance-time graph of the whole journey, indicating the distances travelled at on the vertical axis clearly.

Answer



[3]

23 The figure below is a 16-sided regular polygon formed when the square $ABCD$ is rotated 45° to $EFGH$.
$AB = 12$ cm and $AS = a$ cm.



(a) Explain why $(12-2a)^2 = 2a^2$.

[2]

(b) Show that it simplifies to $a^2 - 24a + 72 = 0$.

Answer

[1]

(c) Solve the equation $a^2 - 24a + 72 = 0$.

or $a =$ ..... [3]

(d) Calculate the perimeter of the 16-sided regular polygon.

Answer .....

..... cm [1]

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