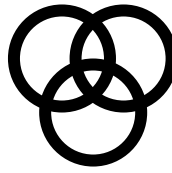


Name: \_\_\_\_\_

Register Number: \_\_\_\_\_

Class: \_\_\_\_\_



南橋中學

**NAN CHIAU HIGH SCHOOL**
**PRELIMINARY EXAMINATION 2026  
SECONDARY FOUR EXPRESS**

For Marker's Use

**MATHEMATICS****4052/01**

Paper 1

**20 August 2026, Thursday****2 hours 15 minutes**

Candidates answer on the Question Paper.

**READ THESE INSTRUCTIONS FIRST**

Write your name, class and register number 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, highlighters, glue or correction fluid.

Answer **all** 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 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.

|                                                    |    |
|----------------------------------------------------|----|
| Lack annotation/ units/ incorrect properties' name | –1 |
| Accuracy                                           | –1 |
| Final answer                                       | –1 |
| Use of Pencil for essential working                | –1 |

***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*

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

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

**Answer all the questions.**

- 1** Express  $-x^2 - 4x + 2$  in the form  $-(x + a)^2 + b$ .

*Answer* .....[2]

---

- 2** Given that  $81^2 = 9(27^{-2x})$ , find  $x$ .

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

---

- 3** Simplify  $\frac{21a^4}{4b^2c^3} \div \frac{14a^3c^{-1}}{12b^3}$ .

*Answer* .....[2]

---

4 Solve  $\frac{x}{5} = \frac{2x-3}{4}$ .

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

---

5 (a) Factorise  $8p^3q - 18pq^3$  completely.

*Answer* .....[2]

(b) (i) Expand and simplify  $(2x + 5y)^2$ .

*Answer* .....[1]

(ii) **Hence or otherwise**, given that  $(2x + 5y)^2 = 4(x^2 - 10x + 25)$ , where  $y$  is a constant. Find the value of  $y$ .

*Answer*  $y =$  .....[1]

---

- 6 (a) It is given that  $p = \frac{q(r-2)}{7-r}$ .

Calculate the value of  $p$  when  $q = 20.26$  and  $r = -8.19$ .  
Give your answer to 2 decimal places.

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

- (b) Rearrange the formula to make  $r$  the subject.

*Answer*  $r =$  .....[3]

---

- 7 The lowest common multiple of  $x$  and 72 is 1800. Given that  $x$  is a perfect square, find the largest possible value of  $x$ .

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

---

- 8 Alice invests \$5000 at a rate of  $r$  % per annum compounded monthly.  
At the end of 13 years, the value of her investment is \$7381. Calculate the value of  $r$ .

*Answer*  $r =$  .....[2]

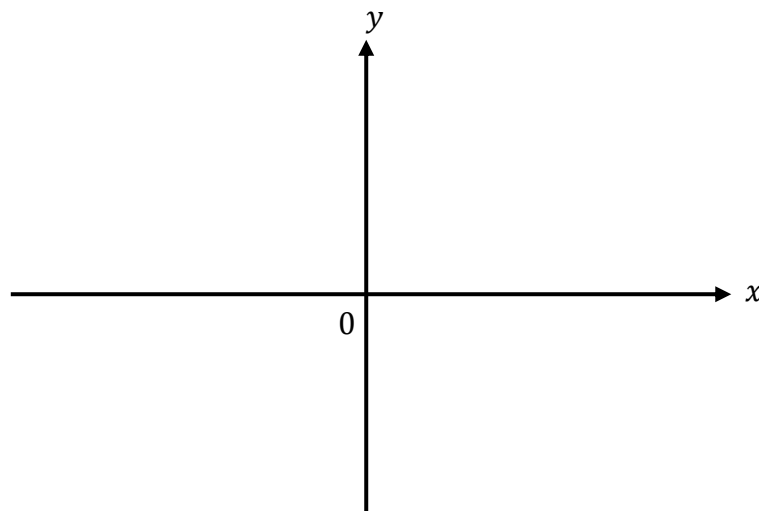
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- 9 A shop imports a smart watch and sells it at a certain price. During a sale, the shop offers a 15% storewide discount. With the 15% discount, the shop still makes a profit of 36% on the cost price of the watch. Given that the selling price of the watch during the sale is \$204, calculate the original profit made if the shop did not have the storewide discount.

Answer \$.....[3]

---

- 10 Sketch the graph of  $y = -(x - 2)(x + 4)$  on the axes below.  
Indicate clearly the coordinates of the points where the graph crosses the axes and the turning point on the curve.



[3]

---

- 11 A courier service uses an electric van to transport standardized parcels from a sorting hub to an automated parcel locker station. The van has two strict load limits that cannot be exceeded.

**Maximum loading weight limit : 850 kg**

**Maximum loading volume limit : 6 m<sup>3</sup>**

Each individual parcel has the following specifications.

**Weight : 22 kg**

**Volume : 150000 cm<sup>3</sup>**

- (a) The courier driver commented that the van will not be able to fit 30 parcels due to the maximum loading volume limit. Do you agree with the worker? Support your answer with workings.

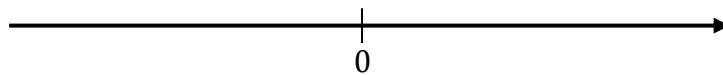
*Answer* I agree / disagree with the worker. [2]

- (b) Given that 4 trolleys weighing 3.8 kg each must also be in the van during transport, calculate the maximum number of parcels that can be safely loaded in one trip?

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

---

- 12** Solve the inequalities  $\frac{x-1}{2} < \frac{5-2x}{3} \leq 2 - \frac{x-3}{4}$  and represent the solutions on the number line below.



[4]

- 13** The points  $A$  and  $B$  have coordinates  $(-3, 2)$  and  $(9, -6)$  respectively.  
**(a)** Find  $\overrightarrow{AB}$  as a column vector.

Answer  $\overrightarrow{AB} = \dots\dots\dots$  [1]

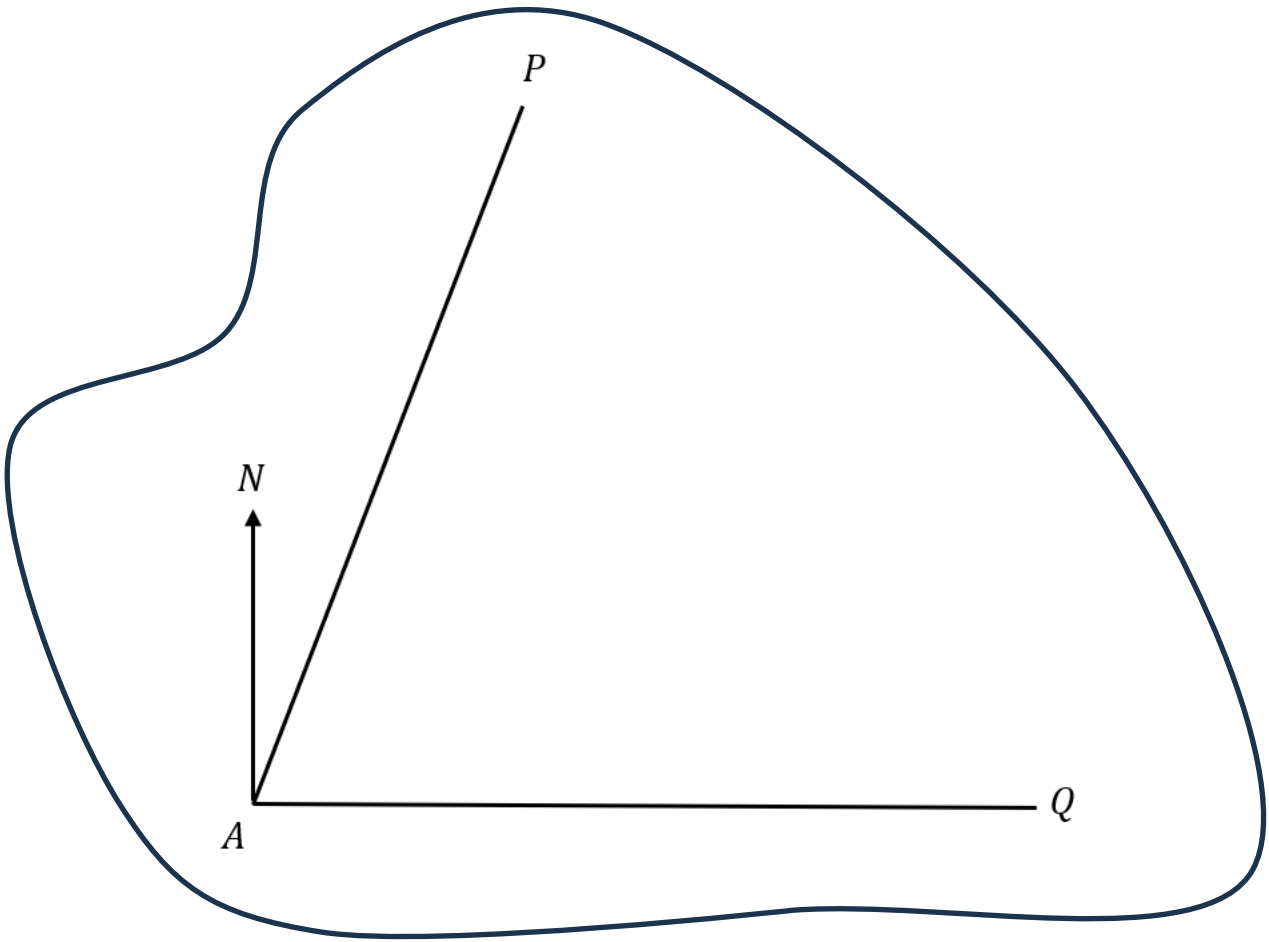
- (b)** By vector method, determine whether the point  $C (3, -2)$  lies on the straight line segment  $AB$ .

Answer

[2]

- 14 The scale drawing shows the position of the visitor centre at  $A$  and two straight cycling paths,  $AP$  and  $AQ$  in a park.

Scale: 1cm to 40 metres



- (a) A scenic lookout tower is located on a bearing of  $065^\circ$  and is 260 m from  $A$ . Mark and label the position of the lookout tower with the letter ' $T$ '. [1]
- (b) A straight footpath, within the park, starting from  $A$  runs exactly halfway between the two cycling paths  $AP$  and  $AQ$ . Construct the line representing this footpath till the boundary of the park. [1]
- (c) A vending machine is to be placed within the park, such that it is equidistant from  $AP$  and  $AQ$ , and equidistant from  $A$  and  $P$ . Mark and label the position of the vending machine with the letter ' $X$ '. [1]
-

- 15** A bag contains 5 red marbles and  $n$  green marbles. Two marbles are drawn at random from the bag, one after the other without replacement. Given that the probability of drawing 2 green marbles is  $\frac{3}{11}$ , find the value of  $n$ .

*Answer*  $n = \dots\dots\dots$ [4]

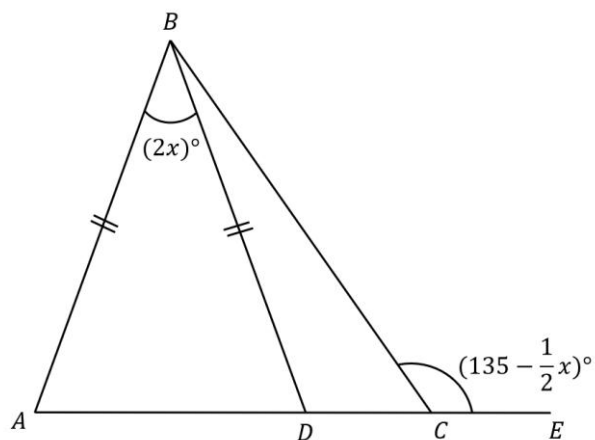
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- 16** Solve the equation  $\frac{3}{2x-3} - \frac{2}{3x-2} = 5$ , giving your solutions correct to 3 decimal places.

*Answer*  $x = \dots\dots\dots$  or  $x = \dots\dots\dots$ [4]

---

- 17 In the diagram,  $ABC$  is a triangle.  $D$  is a point on  $AC$  such that  $AB = BD$  and  $ACE$  is a straight line. Angle  $ABD = (2x)^\circ$  and angle  $BCE = (135 - \frac{1}{2}x)^\circ$ .



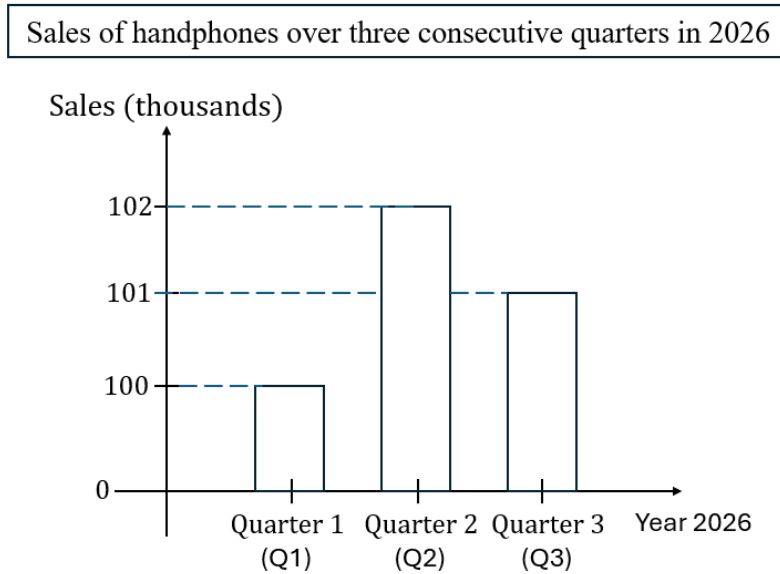
Prove that triangle  $ABC$  is an isosceles triangle.

*Answer*

- 18** A solid sphere with radius  $r$  cm has the same volume as a solid cone with base radius  $r$  cm. The height of the cone is  $h$  cm.  
Show that the total surface area of the solid cone can be expressed in the form  $(\sqrt{a} + 1)\pi r^2$  cm<sup>2</sup>, where  $a$  is an integer.

*Answer*

- 19 The graph shows a company's growth in the sales of handphones over three consecutive quarters in 2026.



- (a) State one misleading feature of the graph.

.....  
 .....[1]

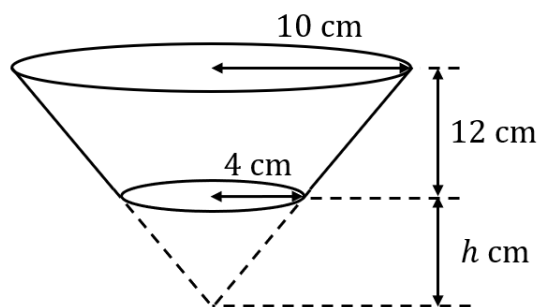
- (b) Explain how this feature affects the reader's interpretation of the graph.

.....  
 .....[1]

- (c) Calculate the percentage change in the sales of handphones from Q2 to Q3.

Answer.....% [2]

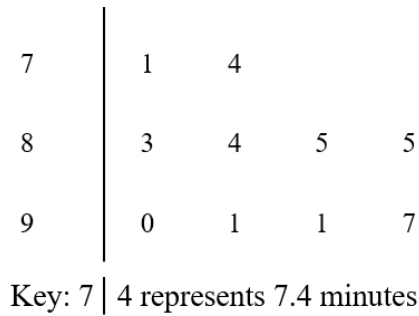
20



The diagram shows a flower pot of height 12 cm. It is obtained when a smaller cone of height  $h$  cm and base radius 4 cm is removed from a larger cone with base radius 10 cm. Jack filled the pot to two-third of its height and commented that the pot is filled to two-third of its volume. Do you agree with Jack? Support your answer with appropriate workings.

*Answer*

- 21** The stem-and-leaf diagram below shows the times taken, in minutes, for 10 boys from school *ABC* to complete a 400 m swim.



**(a)** Calculate an estimate for

**(i)** the mean swim time,

Answer .....min [1]

**(ii)** the standard deviation of the swim time.

Answer .....min [1]

- (b)** Another group of 10 boys from school *XYZ* have a mean swim time of 8.3 minutes and a standard deviation of 0.97 minutes in the 400 m swim. Make two comments comparing the mean and distribution of the swim time of the 20 boys from both schools.

1. ....

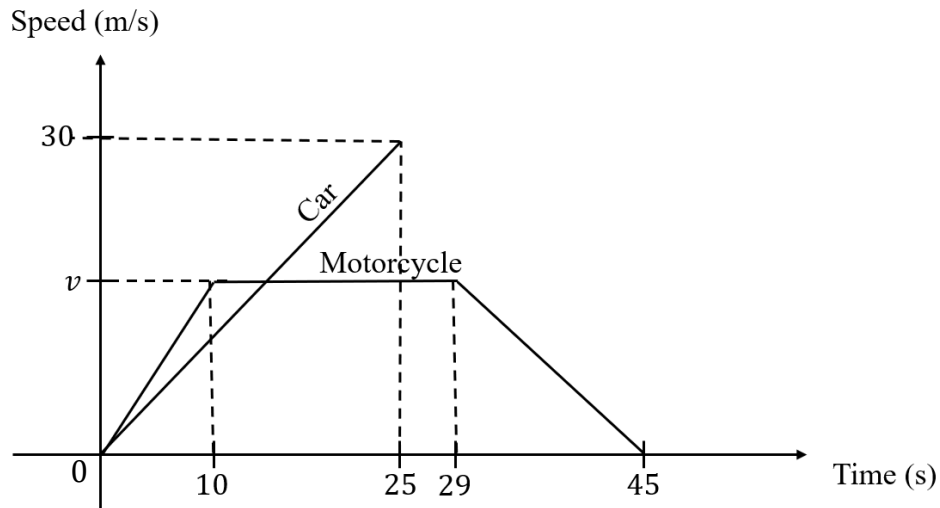
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2. ....

.....

[2]

- 22** The diagram shows the speed-time graphs of a car and a motorcycle, travelling from point  $A$  to point  $B$  along the same road. The car accelerates uniformly from rest for the first 25 seconds. The motorcycle accelerates uniformly from rest for 10 seconds and then travelled at a constant speed of  $v$  m/s before it decelerates uniformly to a stop in the next 16 seconds.



- (a)** Given that the car overtakes the motorcycle at  $t = 25$  seconds, find the value of  $v$ .

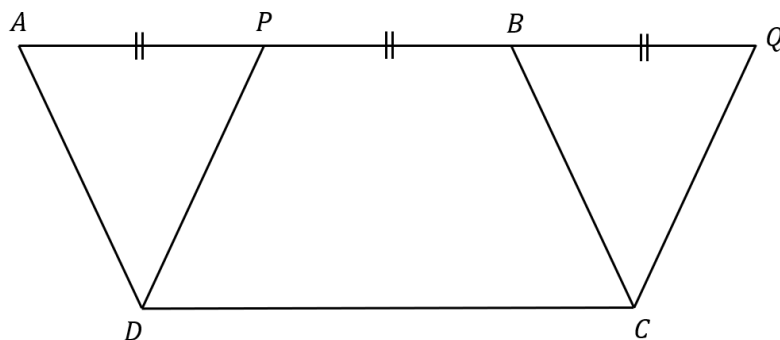
Answer  $v = \dots\dots\dots$  [2]

- (b)** Given that the car decelerates uniformly after  $t = 25$  seconds before it comes to a stop at  $B$ . Calculate the time taken for the car to decelerate uniformly to a stop at point  $B$ .

Answer  $\dots\dots\dots$  s [1]

- (c)** On the above speed-time graph, sketch the remaining portion of the car's journey until it comes to a stop. [1]

- 23** The diagram below shows a panel made up of two identical parallelograms  $ABCD$  and  $PQCD$  overlapping each other in the region  $PBCD$ .  $APBQ$  is a straight line and  $AP = PB = BQ$ .



- (a)** Show that triangle  $ADP$  and triangle  $BCQ$  are congruent.  
Give a reason for each statement you make.

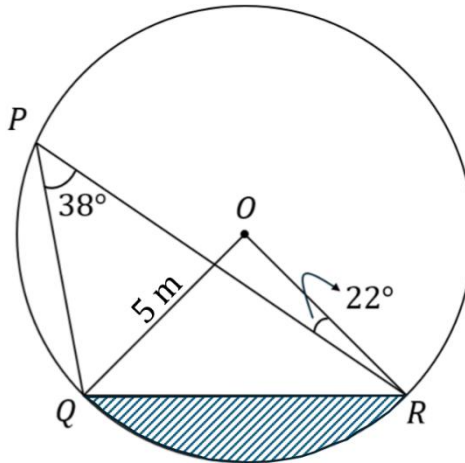
*Answer*

[3]

- (b)** Given that angle  $BQC = 75^\circ$ ,  $CD = 10.5$  cm and  $CQ = 6$  cm, calculate the length of  $DQ$ .

*Answer*  $DQ = \dots\dots\dots$  cm [3]

24



$P$ ,  $Q$  and  $R$  are points on the circumference of a circle with centre  $O$ .  
The radius of the circle is 5 m, angle  $QPR = 38^\circ$  and angle  $ORP = 22^\circ$ .

- (a) Find angle  $OQP$ .  
Give a reason for each step of your working.

Answer Angle  $OQP = \dots\dots\dots$  [3]

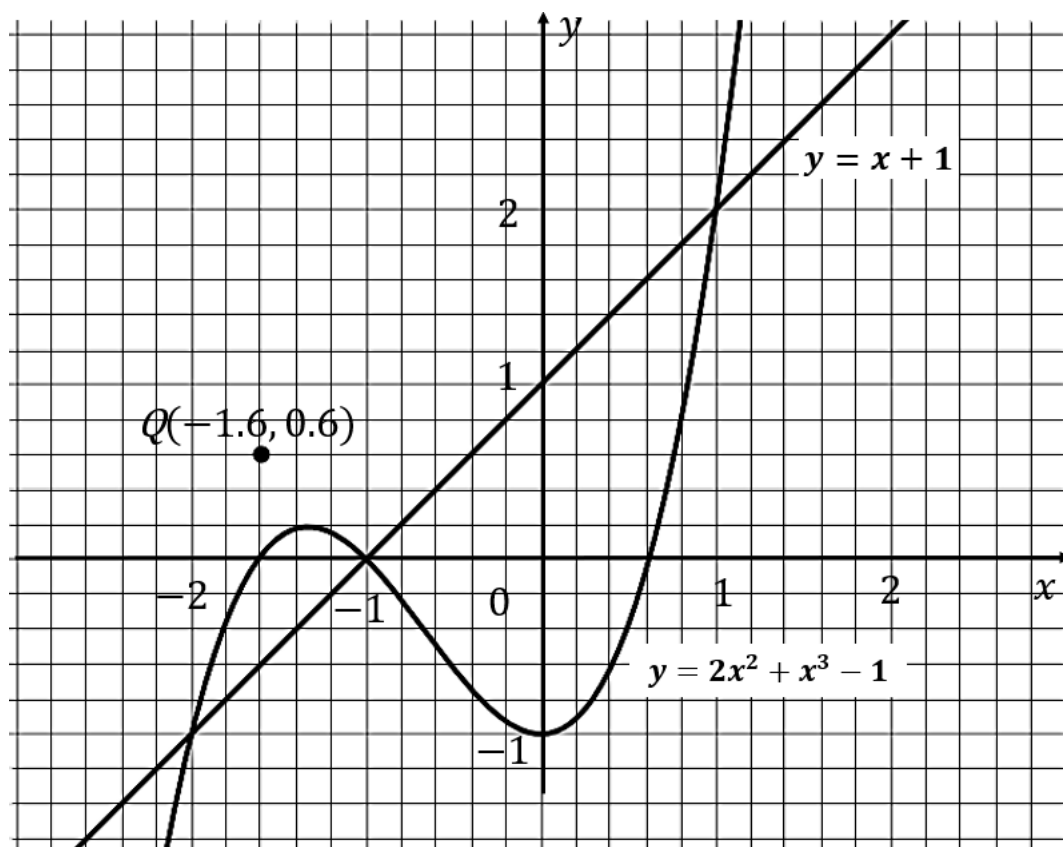
- (b) Explain if it is possible to draw a circle passing through points  $O$ ,  $Q$  and  $R$ , with  $QR$  as the diameter.

$\dots\dots\dots$   
 $\dots\dots\dots$  [1]

- (c) Calculate the area of the shaded segment.

Answer  $\dots\dots\dots$  m<sup>2</sup> [2]

- 25 The graphs of  $y = 2x^2 + x^3 - 1$  and  $y = x + 1$  are drawn on the grid.



- (a) Explain why the equation  $2x^2 + x^3 - 1 = k$  have 3 solutions for some values of  $k$ .

.....  
 .....[1]

- (b) Using the 2 graphs on the grid, find the values of  $a$ ,  $b$ ,  $c$  and  $d$  of the inequality  $ax^3 + bx^2 + cx + d \geq 0$  whose solutions are  $-2 \leq x \leq -1$  or  $x \geq 1$ .

*Answer*  $a = \dots\dots\dots, b = \dots\dots\dots, c = \dots\dots\dots, d = \dots\dots\dots$ [2]

- (c) Point  $Q$  has coordinates  $(-1.6, 0.6)$ . A tangent to the curve can be drawn so that it passes through point  $Q$ .

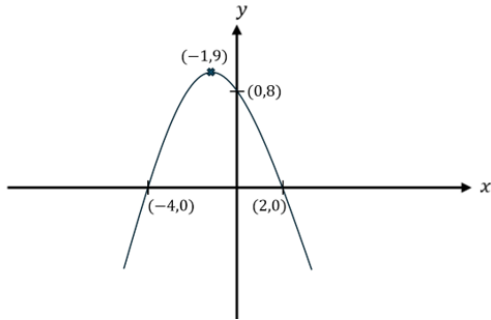
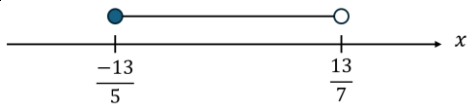
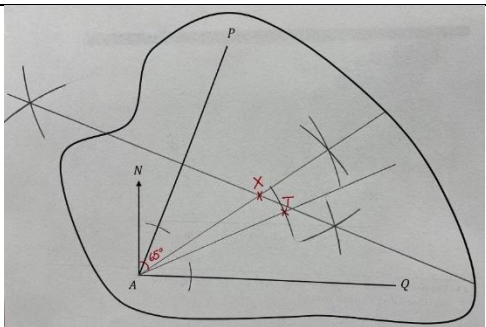
Find the equation of this tangent in the form  $y = mx + c$ , where  $m > 0$ .

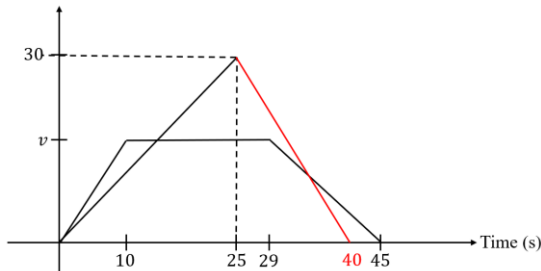
*Answer* .....[2]

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**End of paper**

## Answer key

|      |                                                                                                            |     |                                                                                      |
|------|------------------------------------------------------------------------------------------------------------|-----|--------------------------------------------------------------------------------------|
| 1    | $-(x+2)^2 + 6$                                                                                             | 2   | $x = -1$                                                                             |
| 3    | $\frac{9ab}{2c^2}$                                                                                         | 4   | $x = 2.5$                                                                            |
| 5a   | $2pq(2p-3q)(2p+3q)$                                                                                        | 5bi | $4x^2 + 20xy + 25y^2$                                                                |
| 5bii | $y = -2$                                                                                                   | 6a  | -13.59                                                                               |
| 6b   | $r = \frac{7p+2q}{q+p}$ or $r = \frac{-7p-2q}{-q-p}$                                                       | 7   | $2^2 \times 3^2 \times 5^2 = 900$                                                    |
| 8    | $r = 2.9997 = 3.00$ (3sf)                                                                                  | 9   | Original profit = $240 - 150$<br>= \$90                                              |
| 10   |                          | 11a | $4.5m^3 < 6m^3$<br>Disagree                                                          |
| 11b  | max = 37 parcels                                                                                           | 12a | $\frac{-13}{5} \leq x < \frac{13}{7}$                                                |
| 12b  |                         | 13a | $\begin{pmatrix} 12 \\ -8 \end{pmatrix}$                                             |
| 13b  | Since $\overrightarrow{AC} = -\overrightarrow{BC}$ and C is a common point, C lies on the line segment AB. | 14  |  |
| 15   | $n = 6$ or $n = \frac{-5}{4}$ (NA)                                                                         | 16  | 1.768 or 0.566 (3dp)                                                                 |

|      |                                                                                                                                                                                                      |       |                                                                                                                                                               |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17   | Since angle $ACB = \text{angle } ABC = (45 + \frac{1}{2}x)$ , triangle $ABC$ is isosceles with $AB = AC$ .                                                                                           | 18    | $(\sqrt{17} + 1)\pi r^2$                                                                                                                                      |
| 19a  | Scale of vertical axis is inconsistent                                                                                                                                                               | 19b   | It exaggerates the difference between the quarters. The increase from Q1 to Q2 looks tripled when it only increased by 2%.                                    |
| 19c  | -0.980 %                                                                                                                                                                                             | 20    | $\% \text{ filled} = \frac{56}{117} \times 100\%$<br>$= 47.9\% \neq \frac{2}{3} \text{ of the pot filled}$                                                    |
| 21ai | Mean = 8.51min                                                                                                                                                                                       | 21aii | SD = 0.750min                                                                                                                                                 |
| 21b  | Boys from sch XYZ swim faster as they have a shorter mean time of 8.3 min as compared to 8.51 min.<br>Boys from ABC have a more consistent swim time as the SD is 0.750 mins as compared to 0.97 min | 22a   | $v = 18.75$                                                                                                                                                   |
| 22b  | $t = 15$                                                                                                                                                                                             | 22c   | Speed (m/s)<br><br>Time (s)                                               |
| 23a  | SSS or AAS or AAS acceptable                                                                                                                                                                         | 23b   | 13.4 cm                                                                                                                                                       |
| 24a  | 60                                                                                                                                                                                                   | 24b   | Since Angle $QOR = 76 \neq 90$ , therefore by property of angle in semi-circle, we cannot draw a circle passing through points O, P and Q with QR as diameter |

|     |                                                                                                                                          |     |                             |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------------|
| 25a | For $-1 < k < 0.2$ , there will be 3 points of intersection between $y = k$ and $y = 2x^2 + x^3 - 1$ therefore there will be 3 solutions | 25b | $x^3 + 2x^2 - x - 2 \geq 0$ |
| 25c | $y = 4x + 7$                                                                                                                             |     |                             |