

**Section A**  
[50 marks]  
Answer **all** questions.

- 1 (a) Determine whether the following function has an inverse function or not. Justify your answer.  
 $\{(-2, -1), (0, 1), (2, 3), (4, 3)\}$  [2 marks]
- (b) Diagram 1 shows the relation between the functions  $f$  and  $g$ .

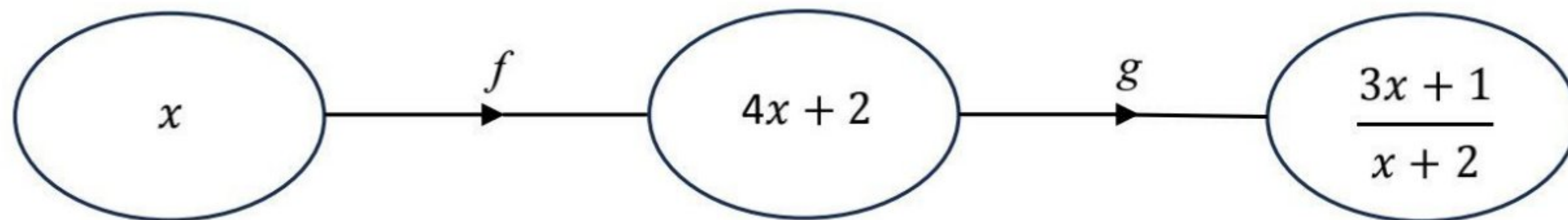


Diagram 1

Find

- (i)  $g(x)$ ,
- (ii) the value of  $p$  if  $p$  is mapped onto itself under the function  $f^{-1}(x)$ .

[6 marks]

Answer :



- 2 As an early preparation to celebrate Mooncake Festival, Yu Ming wishes to hang a few pieces of lanterns at her big house yard. The distance between the two poles of 3 m height is 3 m. Diagram 2 shows the rope used to hang the lanterns was sagging and had a parabolic shape a few days before the festival. The minimum height of the rope from the ground is 200 cm.

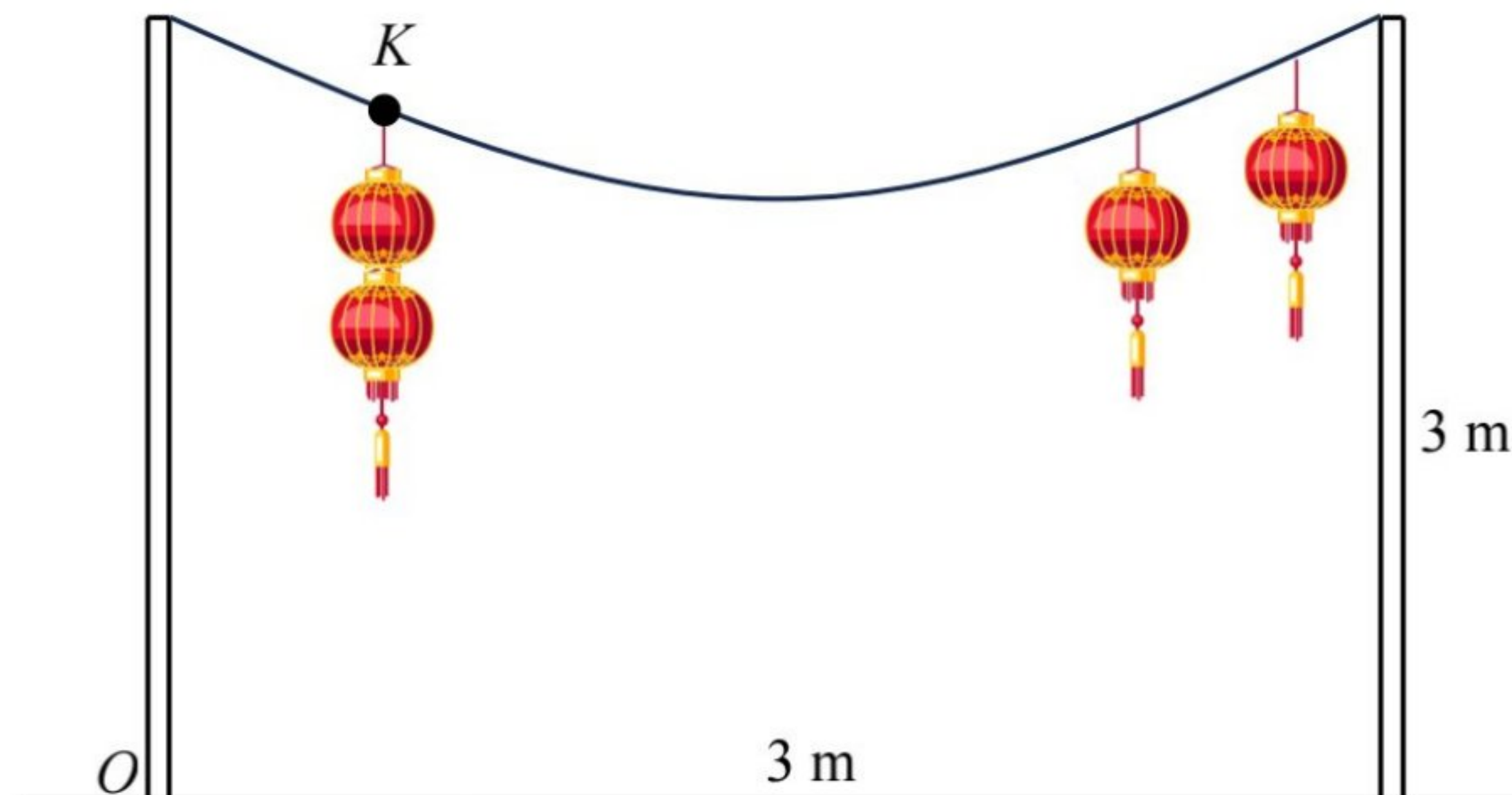


Diagram 2

- (a) Find the equation of the parabolic shaped rope in the form of  $f(x) = a(x - p)^2 + q$ , where  $p$  and  $q$  are constants. Assume the point  $O$  as the origin of the axes. [2 marks]
- (b) Yu Ming plans to hang a few lanterns vertically and tiered at point  $K$  on the rope. Point  $K$  is located 1 m away from the left pole. If the height of a lantern is 20 cm and Yu Ming fixed the minimum height of the base of lantern from the ground to be 150 cm, how many lanterns can be hung by Yu Ming? [4 marks]

Answer :

- 3 A bakery bakes three types of cakes with the monthly cost of RM7750 for 245 cakes. The costs for baking a banana cake, a carrot cake and a chocolate cake are RM20, RM30 and RM40 respectively. The selling prices of baking a banana cake, a carrot cake and a chocolate cake are RM25, RM35 and RM50 respectively. If the bakery intends to make a profit of RM1725 monthly, how many each type of cakes should be baked?

[6 marks]

Answer :



4 (a) Solve the equation  $\log_2 x = 1 + \frac{2}{\log_x 8}$ .

[4 marks]

(b) Given a cylinder with a circumference of a circle  $\frac{2\pi}{\sqrt{2}-1}$  and the height  $(\sqrt{2} + 1)$  cm is filled completely with drinking water. Show that the volume of the drinking water in the cylinder is  $(7 + 5\sqrt{2})\pi \text{ cm}^3$ .

[4 marks]

Answer :

5 Diagram 3 shows a trapezium  $ABCD$ .

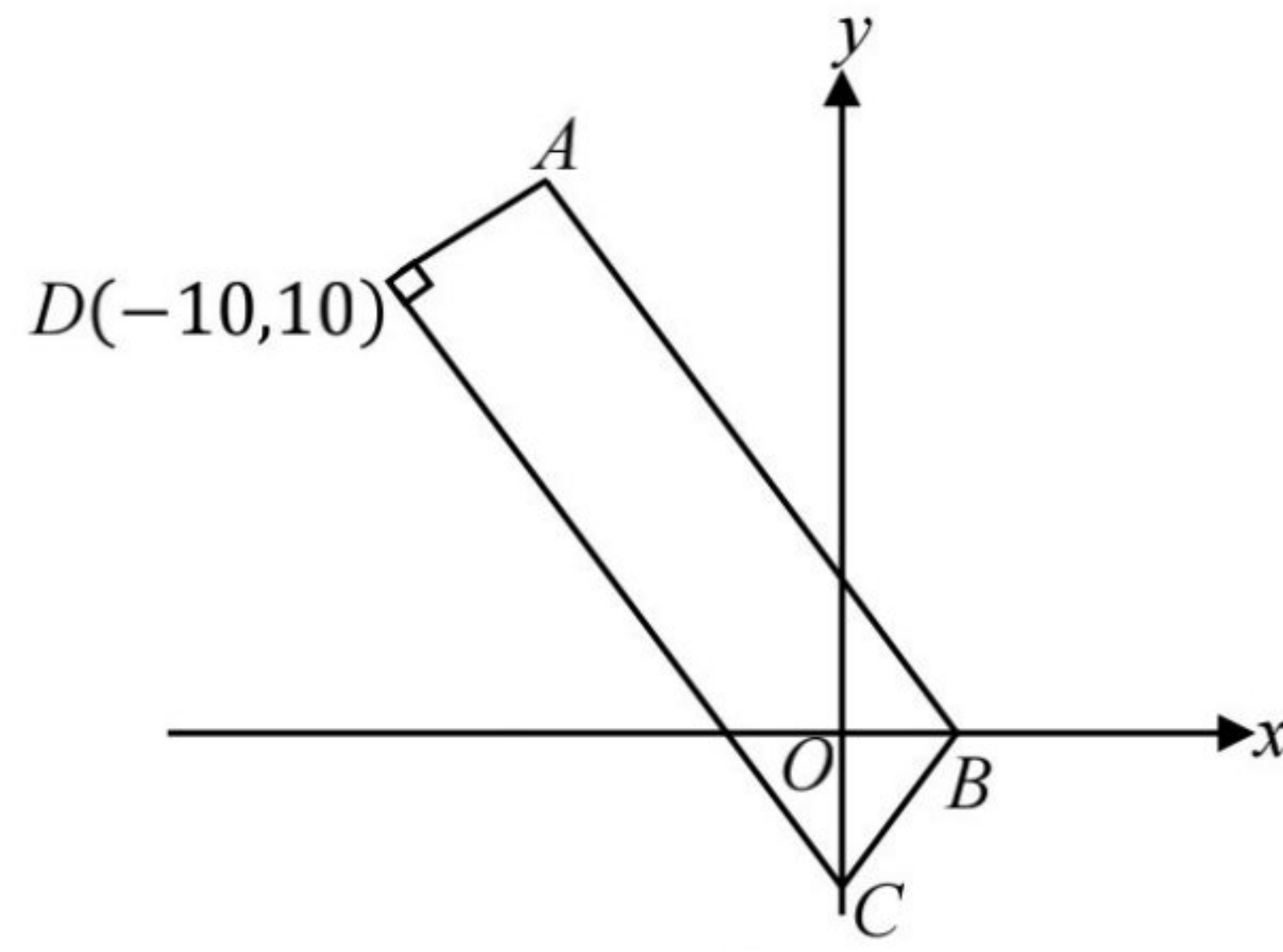


Diagram 3

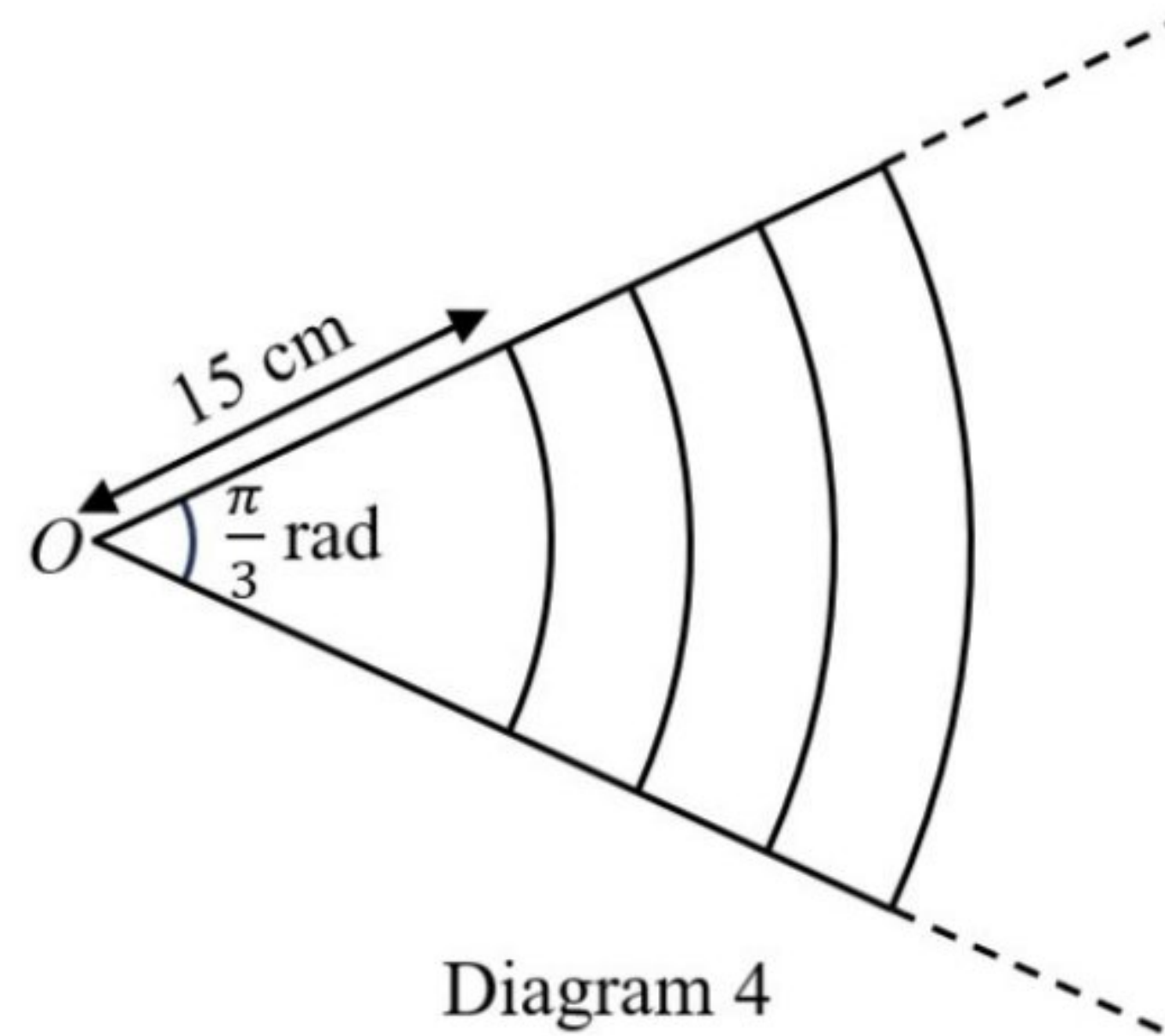
Given the equation of the straight line  $AB$  is  $2y + 3x = 6$ .

Find

- (a) the coordinates of point  $C$ , [2 marks]
- (b) the equation of the straight line  $AD$ , [3 marks]
- (c) the equation of the locus of point  $P$  such that the triangle  $BPD$  has an angle of  $90^\circ$  at  $P$ . [3 marks]

Answer :

- 6 Diagram 4 shows a few sectors of circles with centre  $O$ . The angle subtended at the centre of the circle is  $\frac{\pi}{3}$  radians. The length of each arc increases by  $\pi$  cm successively.



Given that the radius of the  $n$ th sector is 84 cm, find

- (a) the length of arc of the  $n$ th sector, in terms of  $\pi$ ,  
(b) the value of  $n$ ,  
(c) the sum of the length of arcs of the first 10 sectors, in terms of  $\pi$ .

[2 marks]

[3 marks]

[2 marks]

Answer :



- 7 (a) Derive the identity for  $\cos 2\theta = 2 \cos^2\theta - 1$ . [2 marks]
- (b) (i) Hence, sketch the graph of  $y = 2|2 \cos^2\theta - 1| - 1$  for  $0 \leq \theta \leq \pi$ .
- (ii) There is three number of solutions obtained if  $y = m$  is sketched on the same axes in 7(b)(i), such that  $m$  is a constant. State the value of  $m$ . [5 marks]

Answer :

**Section B**

[30 marks]

Answer any **three** questions from this section.

- 8 Diagram 5 shows a trapezium  $PQRS$ , such that  $PS$  is parallel to  $QR$ .

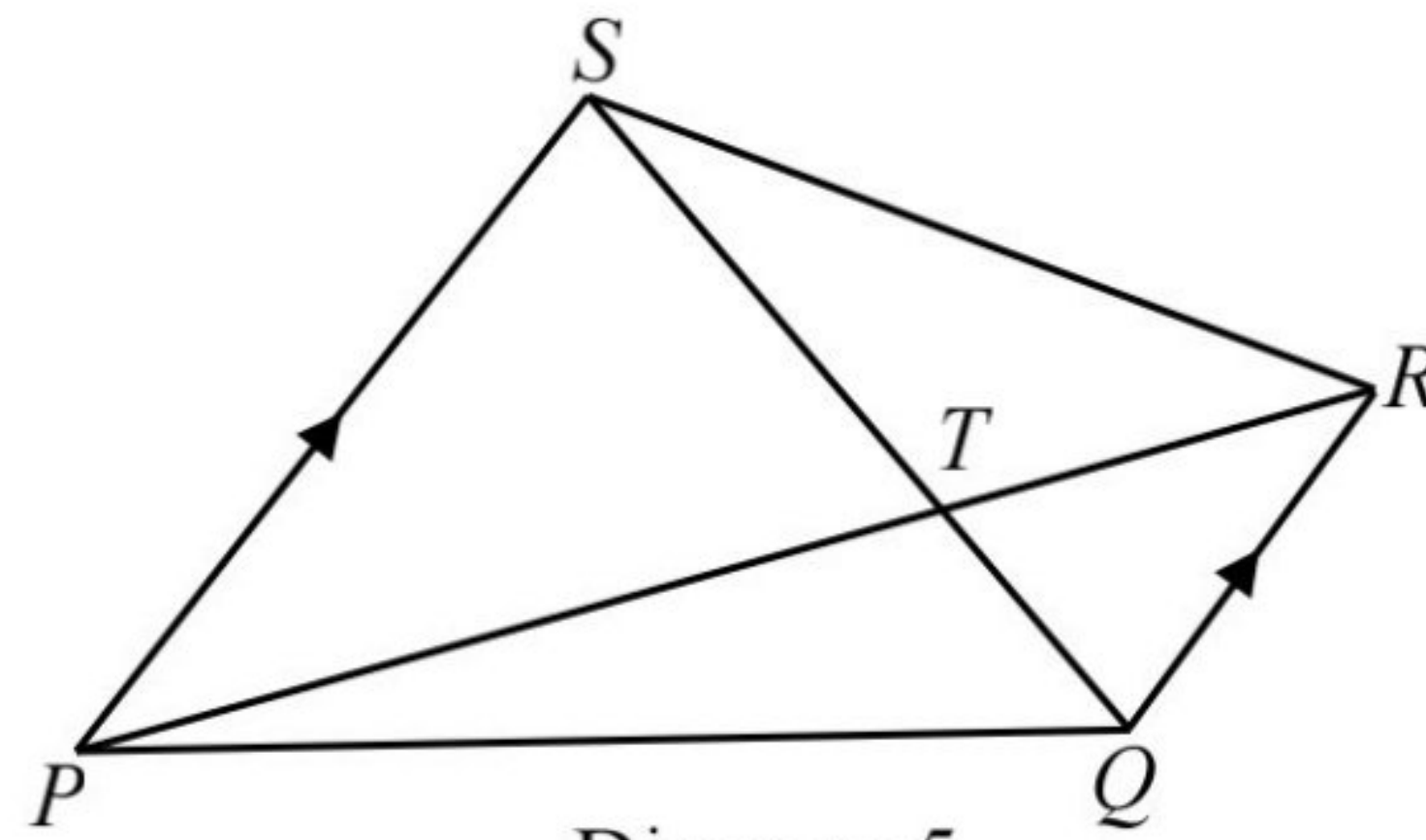


Diagram 5

It is given that  $\vec{PQ} = 8\vec{a}$ ,  $\vec{PS} = 10\vec{b}$  and  $\vec{QR} = \frac{2}{5}\vec{PS}$ .

- (a) Express in terms of  $\vec{a}$  and  $\vec{b}$  :

- (i)  $\vec{PR}$   
(ii)  $\vec{SQ}$

[3 marks]

- (b) It is given that  $\vec{PT} = m\vec{PR}$  and  $\vec{ST} = n\vec{SQ}$ , such that  $m$  and  $n$  are constants. Express

- (i)  $\vec{PT}$  in terms of  $m$ ,  $\vec{a}$  and  $\vec{b}$ ,  
(ii)  $\vec{ST}$  in terms of  $n$ ,  $\vec{a}$  and  $\vec{b}$ .

[3 marks]

- (c) Hence, find the value of  $m$  and of  $n$ .

[4 marks]

Answer :



- 9 Table 1 shows the values of two variables,  $x$  and  $y$ , obtained from an experiment. The variables  $x$  and  $y$  are related by the equation  $y = 2px + \frac{q}{5x}$ , where  $p$  and  $q$  are constants.

$x$	1	2	3	4	5	6
$y$	3.10	2.30	2.33	2.35	2.72	3.00

Table 1

- (a) Based on Table 1, construct a table for the values of  $x^2$  and  $xy$ . [2 marks]
- (b) Plot  $xy$  against  $x^2$ , using a scale of 2 cm to 5 units on the  $x^2$ -axis and 2 cm to 2 units on the  $xy$ -axis.  
Hence, draw the line of best fit. [3 marks]
- (c) Using the graph in 9(b), find the value of  
(i)  $p$ ,  
(ii)  $q$ . [5 marks]

Answer :

**10** The height of a group of police cadet members who participated in a National Day parade is normally distributed with a mean of 165 cm. It is given that the probability of a police cadet member chosen at random has a height less than 164 cm is 0.4502.

- (a) If 6 police cadet members are chosen at random, find the probability that
- (i) exactly 3 police cadet members have the height less than 164 cm,
  - (ii) at most 5 police cadet members have the height less than 164 cm.

[5 marks]

- (b) If a police cadet member is chosen at random, find the probability that the height is more than 167 cm.

[5 marks]

Answer :



- 11 Diagram 6 shows a curve  $y = x^2 - 9$  and the straight line  $PQ$  which is tangent to the curve at the point  $K$ .

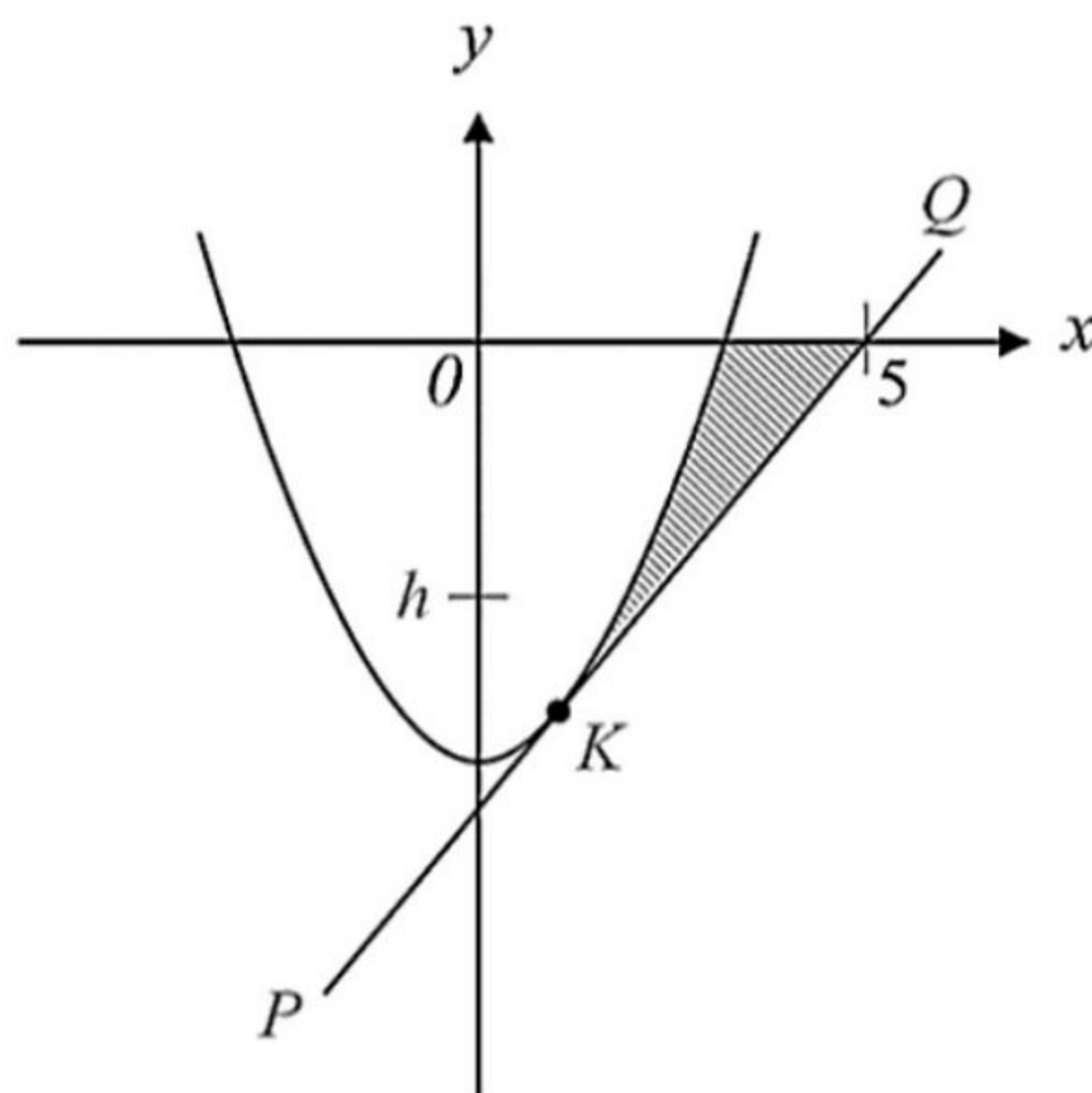


Diagram 6

- (a) Given that the gradient of the straight line  $PQ$  is 2.  
Find the coordinates of the point  $K$ . [2 marks]
- (b) Calculate the area of the shaded region. [5 marks]
- (c) When the region bounded by the curve, the  $x$ -axis and the straight line  $y = h$  is rotated through  $180^\circ$  on the  $y$ -axis, the volume generated is  $40\pi \text{ unit}^3$ . Find the value of  $h$ . [3 marks]

Answer :

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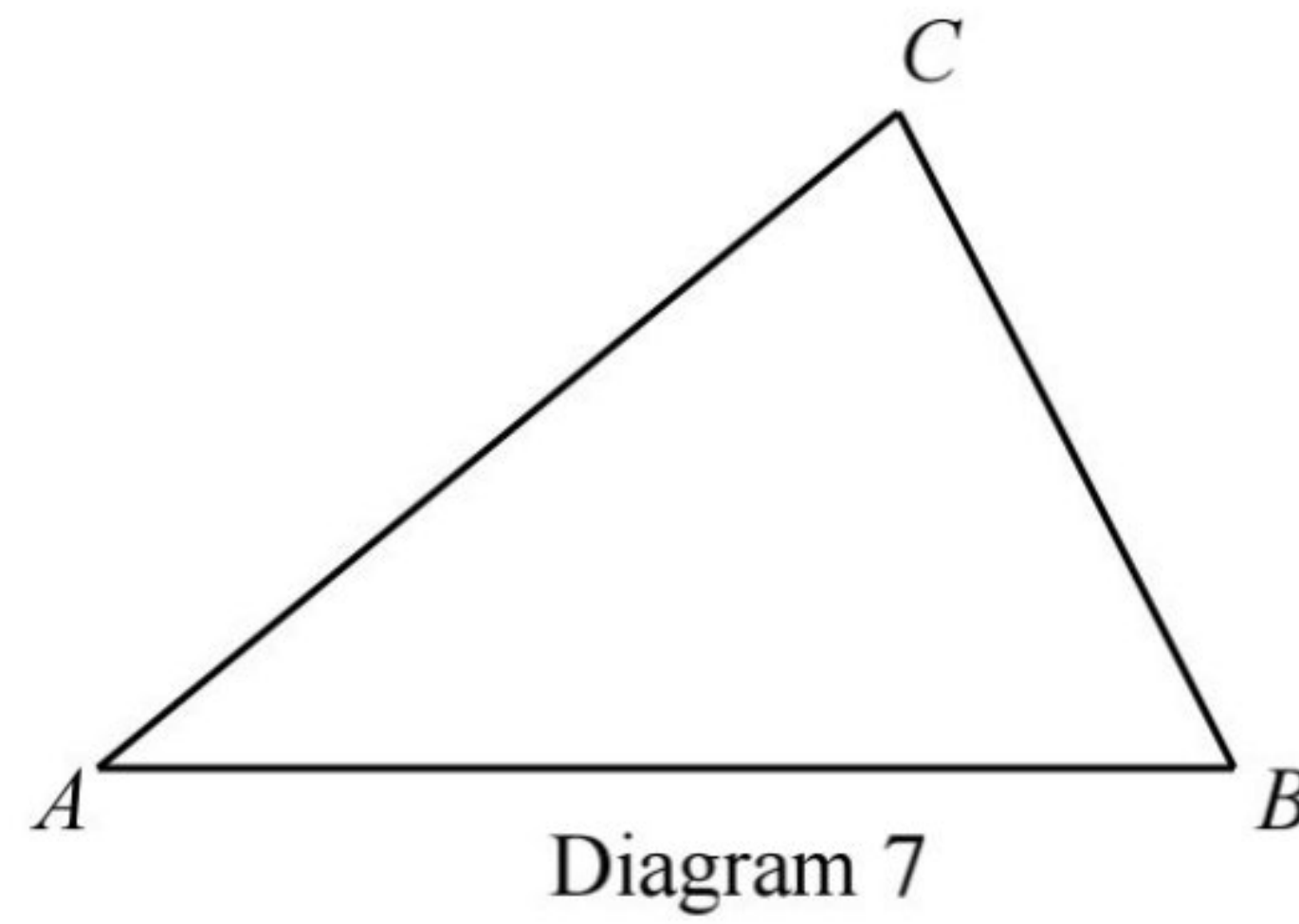


**Section C**

[20 marks]

Answer any **two** questions from this section.

**12** Diagram 7 shows a triangle  $ABC$ .



It is given that  $AB = 5$  cm,  $BC = 4.7$  cm and  $AC = 6.5$  cm. Point  $D$  lies on the line  $AC$  such that  $AD = BD$ .

(a) Find

- (i)  $\angle BAC$ ,
- (ii) the length, in cm, of  $BD$ ,

[4 marks]

(b) Sketch a triangle  $A'B'C'$  which has a different shape from triangle  $ABC$  such that  $B'C' = BC$  and  $\angle B'A'C' = \angle BAC$ .

[1 mark]

(c) Calculate the area, in  $\text{cm}^2$ , of  $\Delta A'B'C'$ .

[5 marks]

Answer :

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**13** Use the graph paper provided to answer this question.

Safiah earns a salary of RM3000 per month. She saves RM $x$  of her salary on children's education and RM $y$  on family recreational activities. She allocates her monthly saving based on the following constraints:

- I The monthly saving for her family recreational activities is at most twice the monthly saving for her children's education.
- II The monthly saving for her family recreational activities is at least RM100 more than the monthly saving for her children's education.
- III The total monthly saving for her children's education and family recreational activities does not exceed 25% of her monthly salary.

- (a) Write three inequalities, other than  $x \geq 0$  and  $y \geq 0$ , which satisfy all the above constraints. [3 marks]
- (b) Using a scale of 2 cm to RM50 on both axes, construct and shade the region **R** which satisfies all the above constraints. [3 marks]
- (c) Using the graph constructed in **13(b)**, find
  - (i) the range of her saving for family recreational activities if she spends RM200 a month for her children's education.
  - (ii) the minimum total saving for children's education and family recreational activities in a year.

[4 marks]

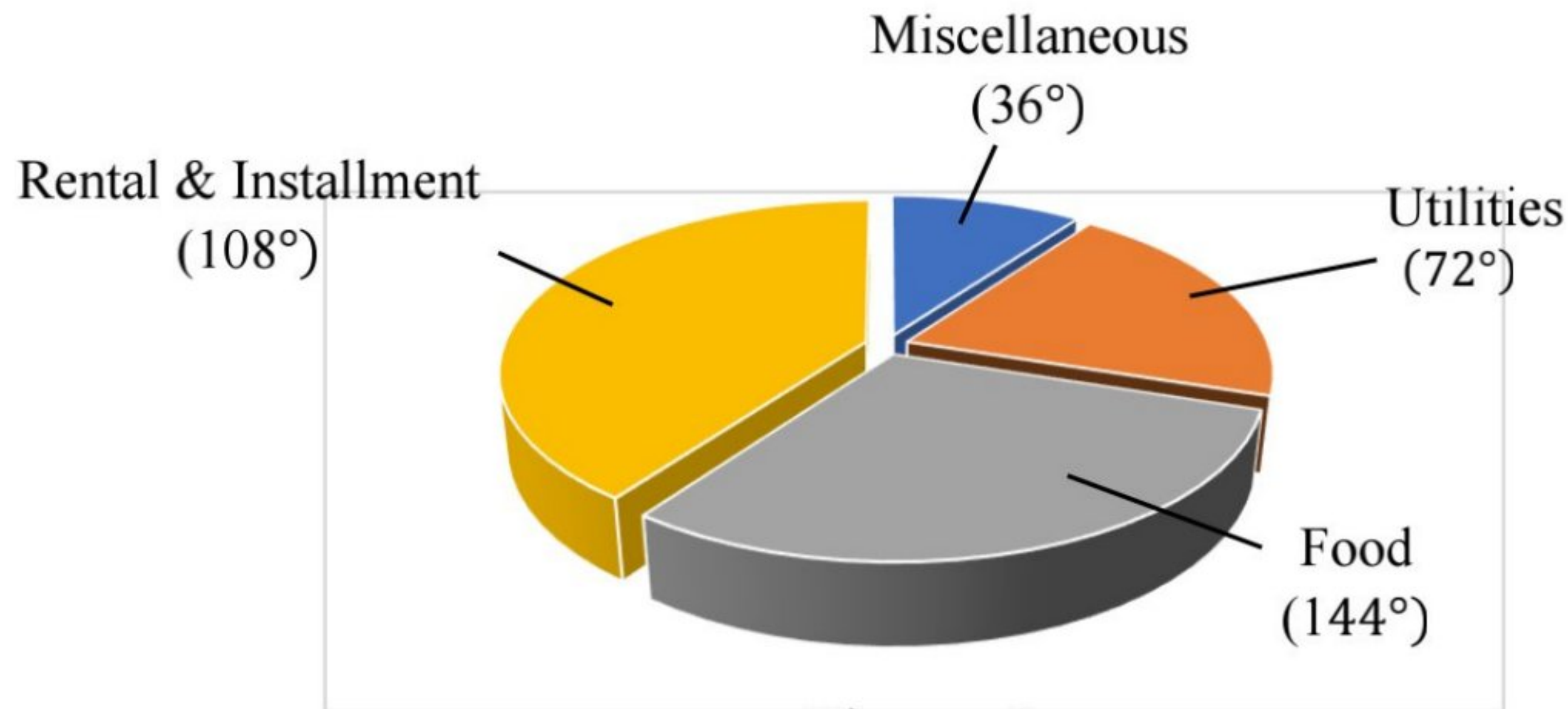
Answer :



- 14 Table 2 shows the price indices and changes in price indices of four main expenses during the Movement Control Order (*MCO*). Diagram 8 shows a pie chart which represents the proportion of the expenses during the *MCO*.

Expenses	Price index in the year 2021 based on the year 2020	Change in the price index from the year 2021 to the year 2022
Food	120	Decreased by 10%
Rent & Installment	$x$	No change
Utilities	150	Increased by 5%
Miscellaneous	108	No change

Table 2



- (a) (i) Calculate the total expenses of food in the year 2020 if the total expenses in the year 2021 is RM720. [2 marks]
- (ii) The composite index for the total expenses in the year 2021 based on the year 2020 is 126.3. Calculate the value of  $x$ . [2 marks]
- (b) Hence, calculate the composite index for the total expenses in the year 2022 based on the year 2020. State your interpretation based on the composite index number obtained. [4 marks]
- (c) Calculate the total expenses in the year 2022 if the corresponding total expenses in the year 2020 is RM4000. [2 marks]

Answer :



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15 Diagram 9 shows the initial positions of balls  $P$  and  $Q$  that move on a straight line.

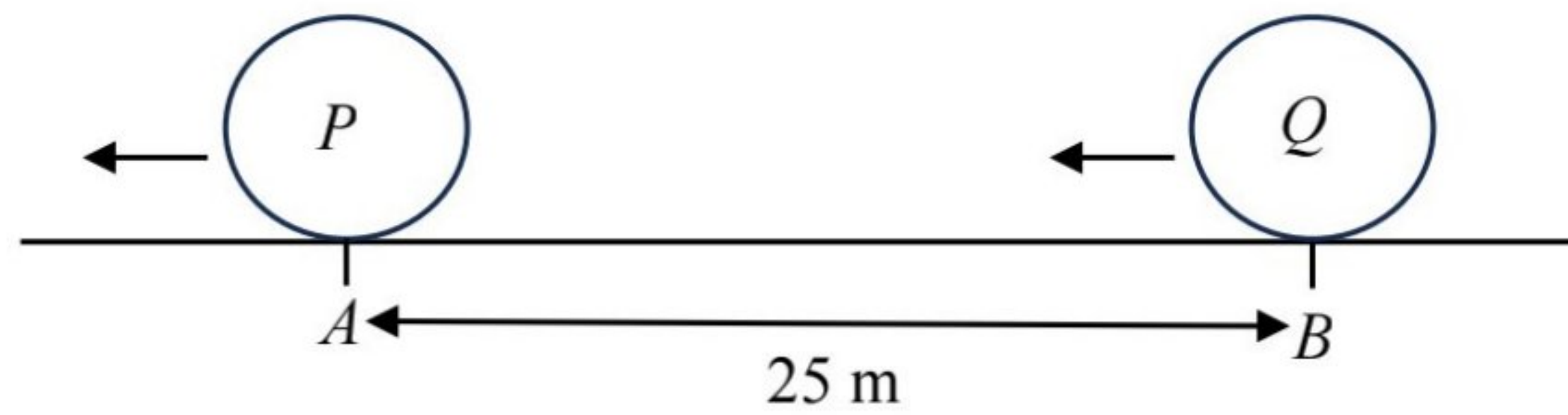


Diagram 9

Ball  $P$  starts to move from point  $A$  with a velocity,  $v_p$   $\text{m s}^{-1}$  is given by  $v_p = t^2 - t - 6$ , such that  $t$  is time, in seconds. Ball  $Q$  moves from point  $B$  with a constant velocity of  $-7 \text{ m s}^{-1}$ .

Find

- (a) the maximum velocity, in  $\text{m s}^{-1}$ , of ball  $P$ , [3 marks]
- (b) the distance of ball  $P$  from point  $A$  when it is instantaneously at rest, [4 marks]
- (c) the position of ball  $Q$  from point  $A$  when ball  $P$  stops instantaneously. [3 marks]

Answer :

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