

SULIT

NAMA		TINGKATAN	5
------	--	-----------	---

PEPERIKSAAN
ADDITIONAL MATHEMATICS
Kertas 1

TAHUN 2023

3472/1

2 jam

2 jam

JANGAN BUKA KERTAS PEPERIKSAAN INI SEHINGGA DIBERITAHU

1. *This question paper consists of 15 questions.*
2. *Answer **all** questions in Section A, any two questions from Section B.*
3. *Write your answers in the spaces provided in the question paper.*
4. *Show your working. It may help you to get marks.*
5. *If you wish to change your answer, cross out the answer that you have done. Then write down the new answer.*
6. *The diagrams provided in the questions are not drawn to scale unless stated.*
7. *The marks allocated for each question and sub-part of a question are shown in brackets.*
8. *You may use a scientific calculator.*
9. *A list of formulae is provided.*
10. *Hand in this question paper to the invigilator at the end of the examination.*

Untuk Kegunaan Pemeriksa			
Kod Pemeriksa:			
Bahagian	Soalan	Markah Penuh	Markah diperoleh
A	1	6	
	2	6	
	3	5	
	4	4	
	5	7	
	6	5	
	7	6	
	8	6	
	9	6	
	10	5	
	11	4	
	12	4	
B	13	8	
	14	8	
	15	8	
Jumlah		80	

Kertas peperiksaan ini mengandungi 16 halaman bercetak.

3472/2

[Lihat halaman sebelah
SULIT

The following formulae may be helpful in answering the questions. The symbols given are the ones commonly used.

$$1. x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$2. \log_a b = \frac{\log_c b}{\log_c a}$$

$$3. T_n = a + (n-1)d$$

$$4. T_n = ar^{n-1}$$

$$5. S_n = \frac{n}{2}[2a + (n-1)d]$$

$$6. S_n = \frac{a(r^n - 1)}{r - 1} = \frac{a(1 - r^n)}{1 - r}, r \neq 1$$

$$7. z = \frac{X - \mu}{\sigma}$$

$$8. P(X = r) = {}^n C_r p^r q^{n-r}, p + q = 1$$

$$9. {}^n P_r = \frac{n!}{(n-r)!}$$

$$10. {}^n C_r = \frac{n!}{(n-r)!r!}$$

$$11. I = \frac{Q_1}{Q_0} \times 100$$

$$12. \bar{I} = \frac{\sum I_i w_i}{\sum w_i}$$

$$13. \sin^2 A + \cos^2 A = 1$$

$$14. \sec^2 A = 1 + \tan^2 A$$

$$15. \operatorname{cosec}^2 A = 1 + \cot^2 A$$

$$16. \sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$17. \cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$18. \tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$19. \sin 2A = 2 \sin A \cos A$$

$$20. \cos 2A = \cos^2 A - \sin^2 A$$

$$= 2 \cos^2 A - 1$$

$$= 1 - 2 \sin^2 A$$

$$21. \tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

$$22. \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$23. a^2 = b^2 + c^2 - 2bc \cos A$$

$$24. \text{Area of triangle} = \frac{1}{2} ab \sin c$$

Section A

[64 marks]

Answer **all** questions

1. (a) Diagram 1 shows the graph of the function $f : x \rightarrow \frac{1}{x-2}$, $x \neq 2$.

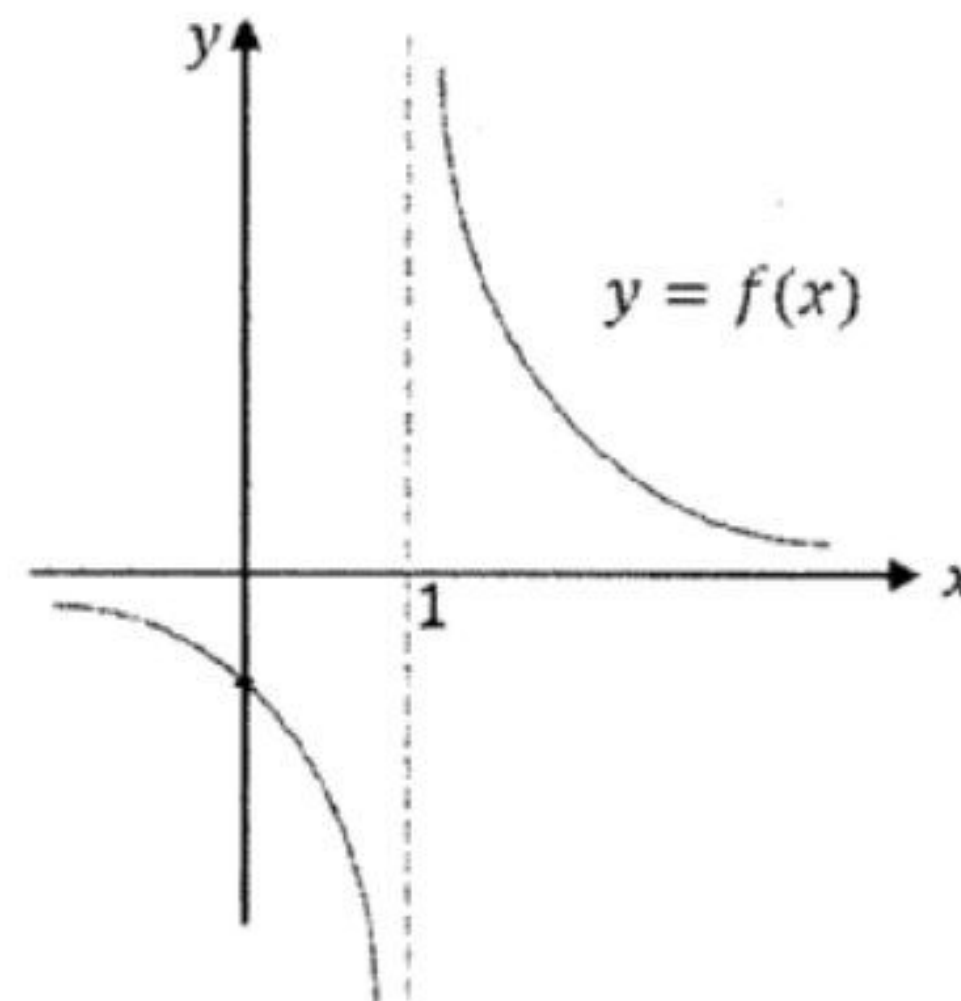


Diagram 1

State whether the function has an inverse function or not. Give your justification.

[1 mark]

- (b) Diagram 2 shows Set A maps to Set B by the function f while function g maps Set B to Set A .

Given function $f(x) = \frac{8x-1}{x}$, $x \neq 0$.

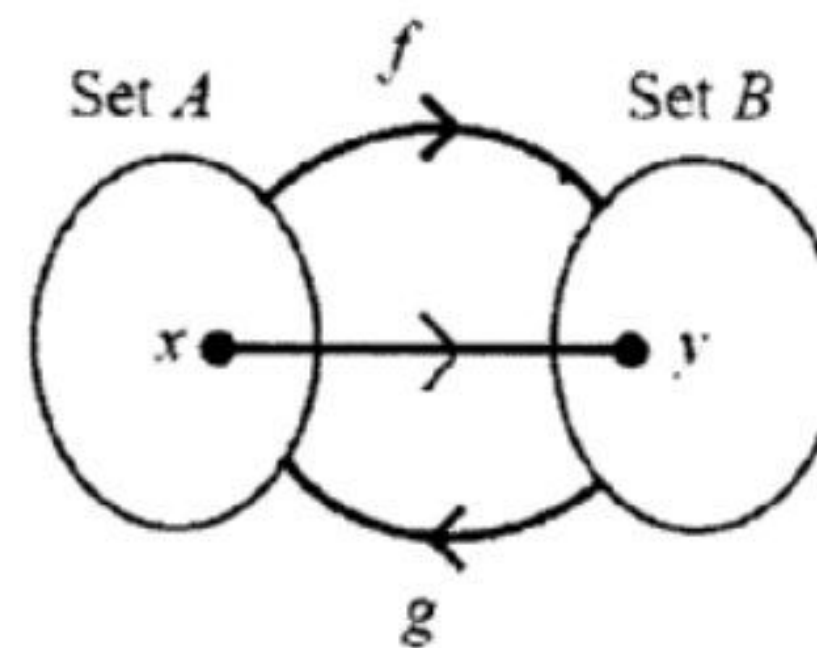


Diagram 2

- (i) Find the image in Set B if the object in Set A is 2 under function f .

[2 marks]

- (ii) Find the function $g(x)$. Hence, state the value of x such that $g(x)$ is undefined.

[3 marks]

Answer:

2. (a) Given that $f(x) = x^2 - 3x$, find the range of the values of x if $5x + 2f(x) > 10$.

[3 marks]

- (b) If α and β are the roots of the quadratic equation $x^2 - 3x - 5 = 0$, form a quadratic equation with the roots $\frac{1}{\alpha}$ and $\frac{1}{\beta}$.

[3 marks]

Answer:

SULIT

3472/1

3. (a) Given that points $A(2,5)$, $B(-1,8)$ and $C(7,h)$ are three points on the Cartesian plane, find the value of h so that triangle ABC does not exist.

[2 marks]

- (b) Diagram 3 shows the graph of $y = f(x)$.

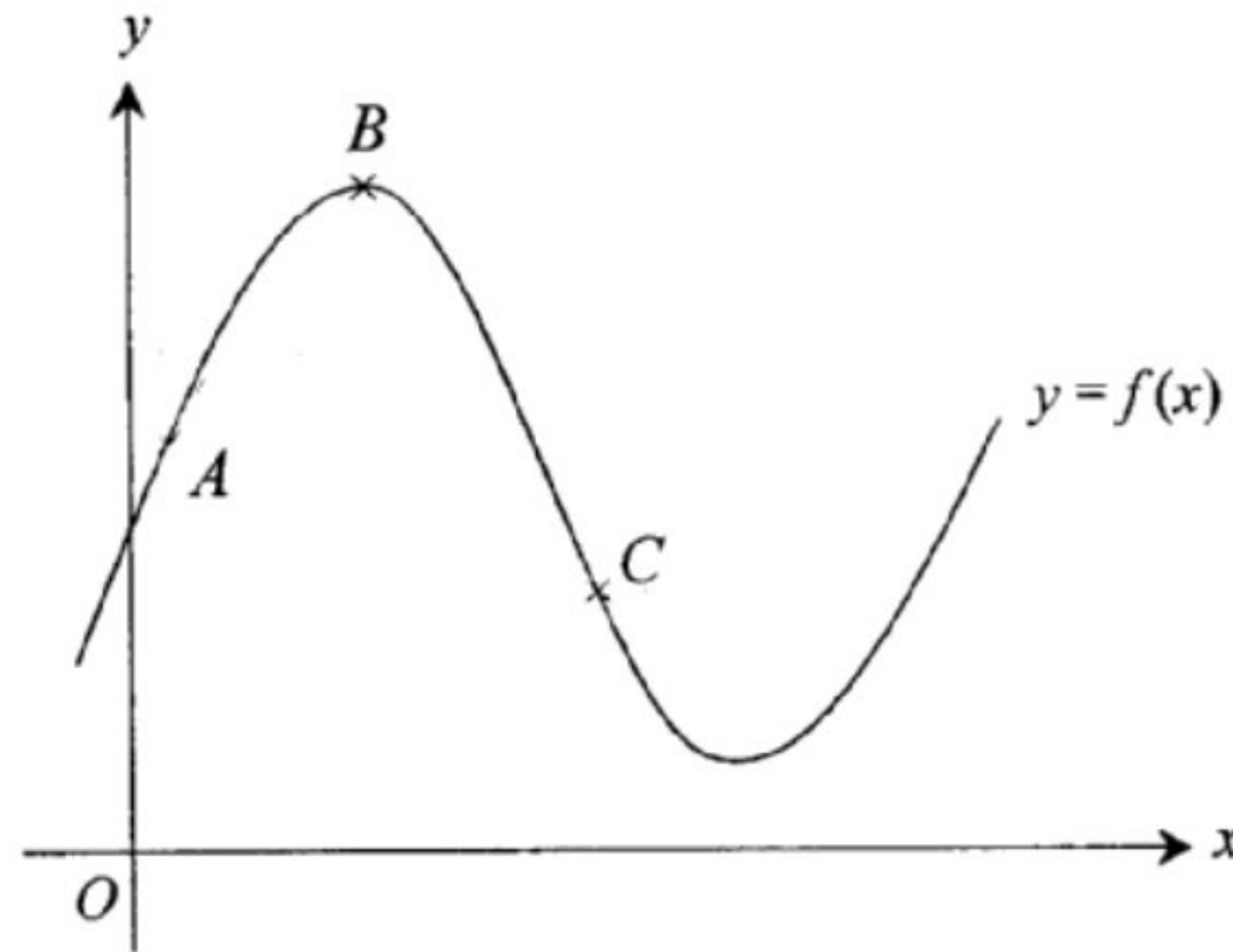


Diagram 3

State the value or range of value of $\frac{dy}{dx}$ for the point

- (i) A
- (ii) B
- (iii) C

[3 marks]

Answer:

4. Diagram 4 shows a graph of the curve $y = \sqrt{3x+4}$, a straight line $x = k$ and $x = 4$.

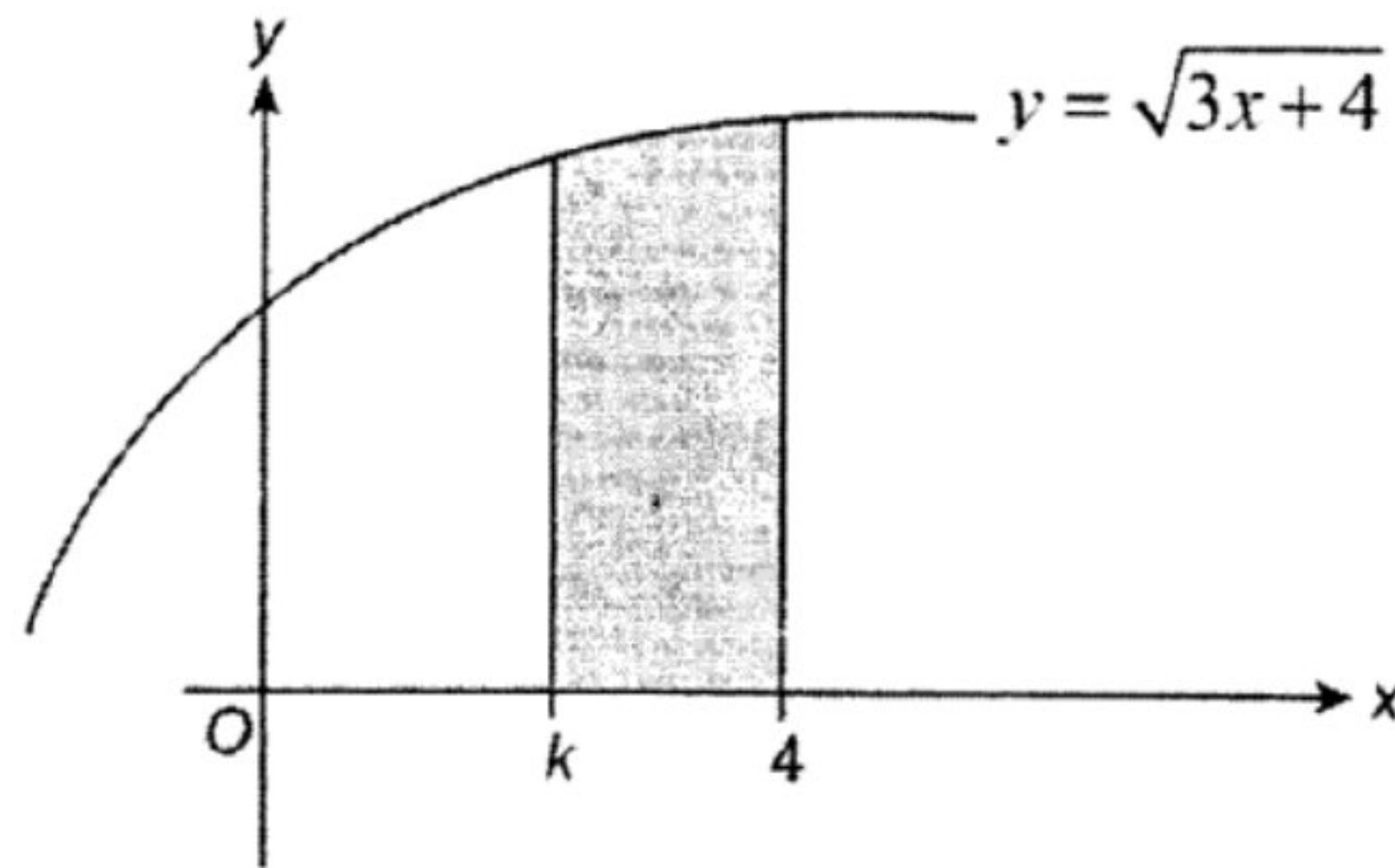


Diagram 4

Given that the volume generated when the shaded region is rotated through 360° about the x -axis is 26π unit³. Find the value of k .

[4 marks]

Answer:

SULIT

3472/1

5. (a) Given $\frac{d}{dx} \left[\frac{(2x+1)^3}{x-3} \right] = \frac{(2x+1)^2(4x-19)}{(x-3)^2}$, find the value of $\int_4^5 \frac{(2x+1)^2(8x-38)}{3(x-3)^2} dx$.

[3 marks]

(b) A straight line $y = 10$ is a tangent to the curve $y = g(x)$. Given that $g''(x) = -4$, find the equation of the curve when $g'(1) = -8$.

[4 marks]

Answer:

SULIT

3472/1

6. Diagram 5 shows a semicircle with centre O .

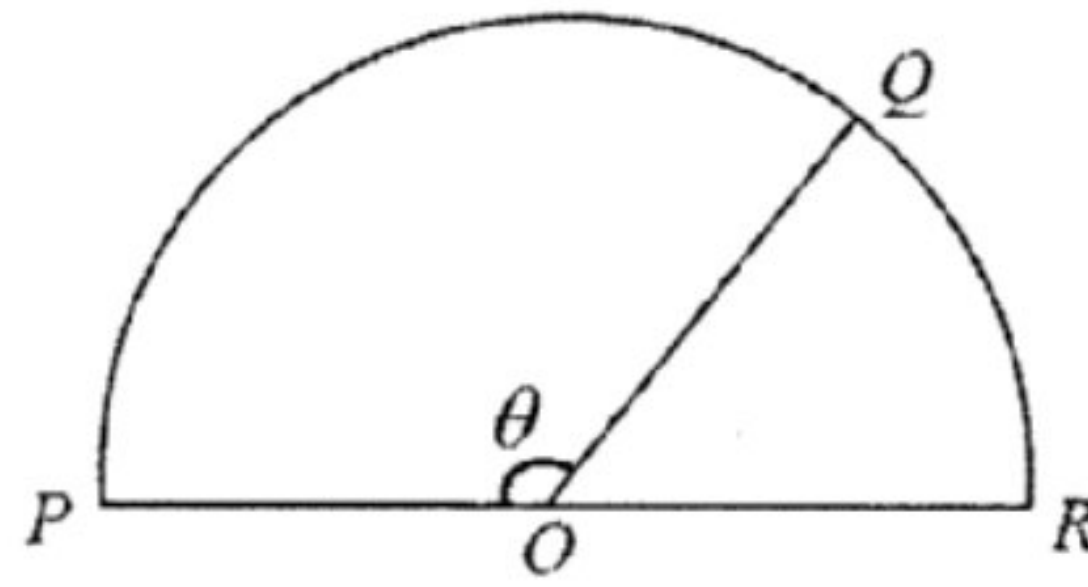


Diagram 5

Given that the arc $PQ = 9$ cm and the perimeter of sector $POQ = 19$ cm. Find

[Use $\pi = 3.142$]

(a) the value θ in degree,

[3 marks]

(b) the perimeter of sector QOR .

[2 marks]

Answer:

SULIT

3472/1

7. (a) Solve the equation $\log_2 x - \log_2 (x-3) - 2 = 0$.

[3 marks]

(b) Simplify $\sqrt{8} + \frac{2}{1-\sqrt{2}}$.

[3 marks]

Answer:

8. (a) Permutation of r objects from n objects can be written as ${}^n P_r$. What is the minimum value of r ?

[1 mark]

(b) Five Form 5 students are to be selected from 4 class monitors, 3 assistant class monitors and 6 prefects to form a football team. Find the number of different ways to form the team if

(i) there is no condition,

(ii) the team consists of 2 class monitors and 2 prefects.

(iii) all the class monitors must be selected.

[5 marks]

Answer:

9. The diagram below shows seven numbered cards.



Five digit numbers are to be formed by using five of these cards without repetition.

(a) How many different numbers can be formed without repetition?

[2 marks]

(b) How many even numbers can be formed?

[2 marks]

(c) How many of the number formed in (b) are greater than 40 000?

[2 marks]

Answer:

SULIT

3472/1

10. Diagram 6 shows a pentagonal shaped swimming pool $ABCDE$. Five poles are placed at point A , B , C , D , and E . Point F is the midpoint of DC . Given that $\overrightarrow{DE} = \frac{2}{3}\overrightarrow{AB}$, $\overrightarrow{BC} = \frac{1}{2}\overrightarrow{AD}$, $\overrightarrow{AB} = 6\mathbf{q}$, $\overrightarrow{AD} = 6\mathbf{p}$, $|\mathbf{p}| = 2$ units and $|\mathbf{q}| = 1$ unit.

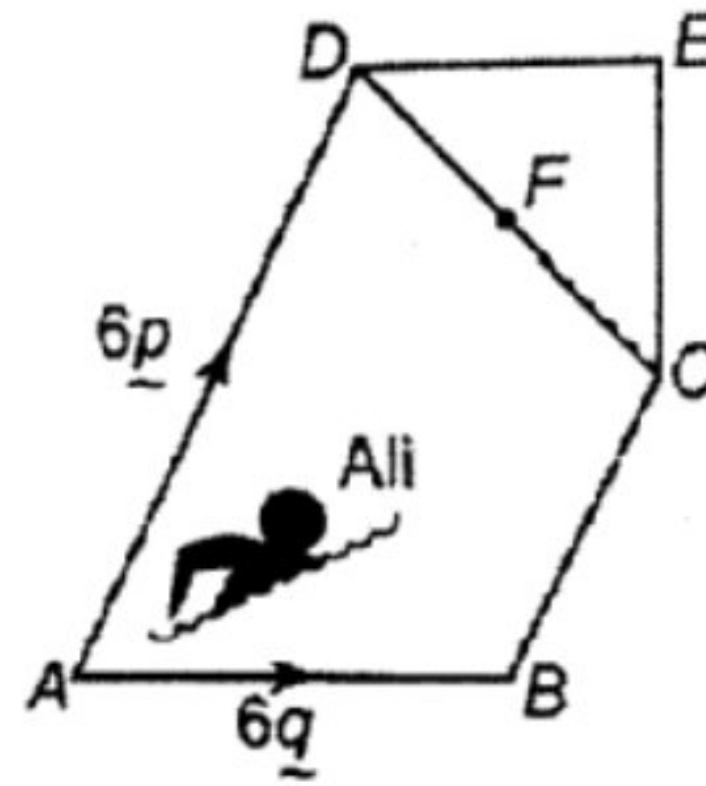


Diagram 6

- (a) If Ali swims from pole A to pole C , calculate the magnitude covered by Ali. [2 marks]
- (b) Another swimmer, Badrul, swims from pole A to pole E passing through point F . Determine whether the points A , F and E are collinear. [3 marks]

Answer:

11. The variables x and y are related by equation $y = p\sqrt{x} - \frac{5}{\sqrt{x}}$ where p is a constant. Diagram 7(a) and Diagram 7(b) show the straight line graphs obtained by plotting the relations from the equation.

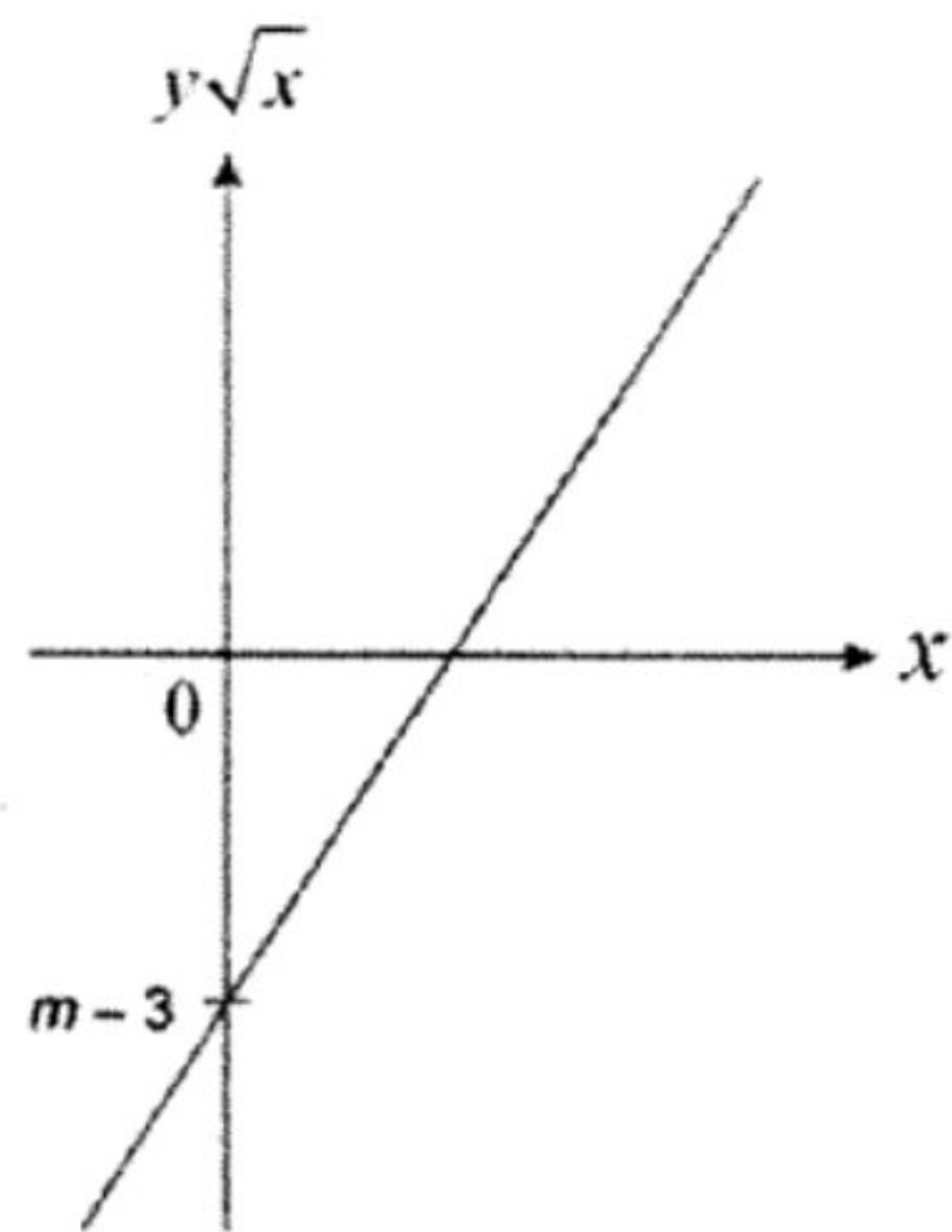


Diagram 7(a)

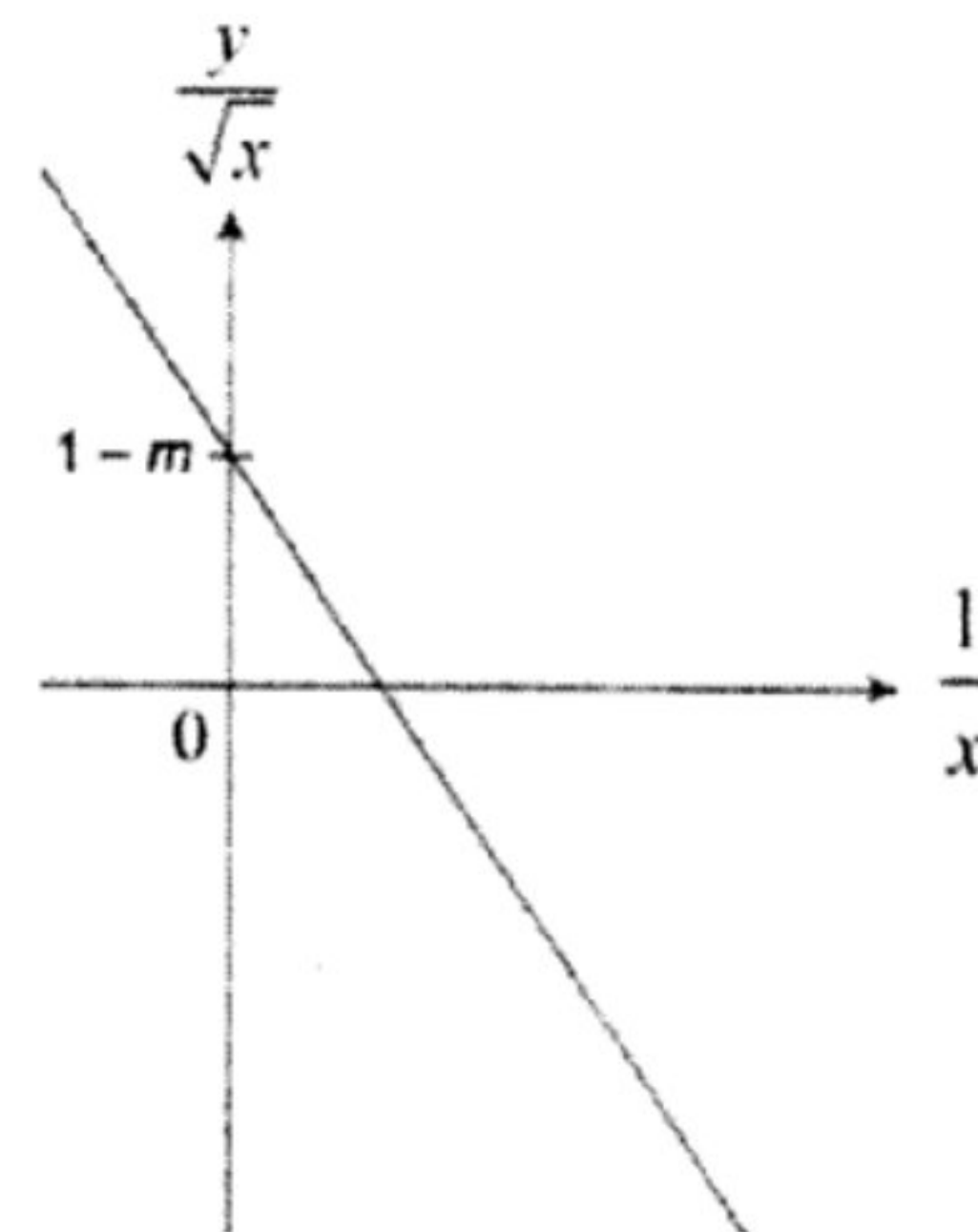


Diagram 7(b)

Find the value of m and of p .

Answer:

[4 marks]

12. Adam has just completed his diploma in engineering field. He was offered a job from two different companies. Syarikat Satria offered him an initial salary of RM36 000 per annum with 5% yearly increment from the basic salary. Syarikat Perdana offered an initial salary of RM30 000 per annum with 9% yearly increment from the basic salary. Adam decided to choose the company which offered higher income and save 20% of his salary for further study after working for 10 years. Which company should Adam choose and how much his total saving after working for 10 years. [Round off your answer to the nearest RM]

[4 marks]

Answer:

Section B

[16 marks]

Answer any **two** questions from this section

13. A quadratic function $f(x) = 2[(x - h)^2 + k]$, where h and k are constants, has a minimum point $(2t, 3t^2)$.

(a) State the value of h and of k in terms of t .

[2 marks]

(b) If $t = 2$, sketch the graph of $f(x)$ for domain $-4 \leq x \leq 6$.

[3 marks]

(c) Using the same value of t in question (b), find the range of n such that the equation $f(x) = n$ has two real and distinct roots.

[3 marks]

Answer:

SULIT

3472/1

14. (a) Given that $g : x \rightarrow px - 5$ and $h : x \rightarrow x^2 + q$. If $gh(2) = 1$, express q in terms of p .

[3 marks]

(b) Diagram 8 shows a bowl with a height of 8 cm and a diameter of 16 cm. The parabolic bowl is represented by the equation $y = ax^2$.

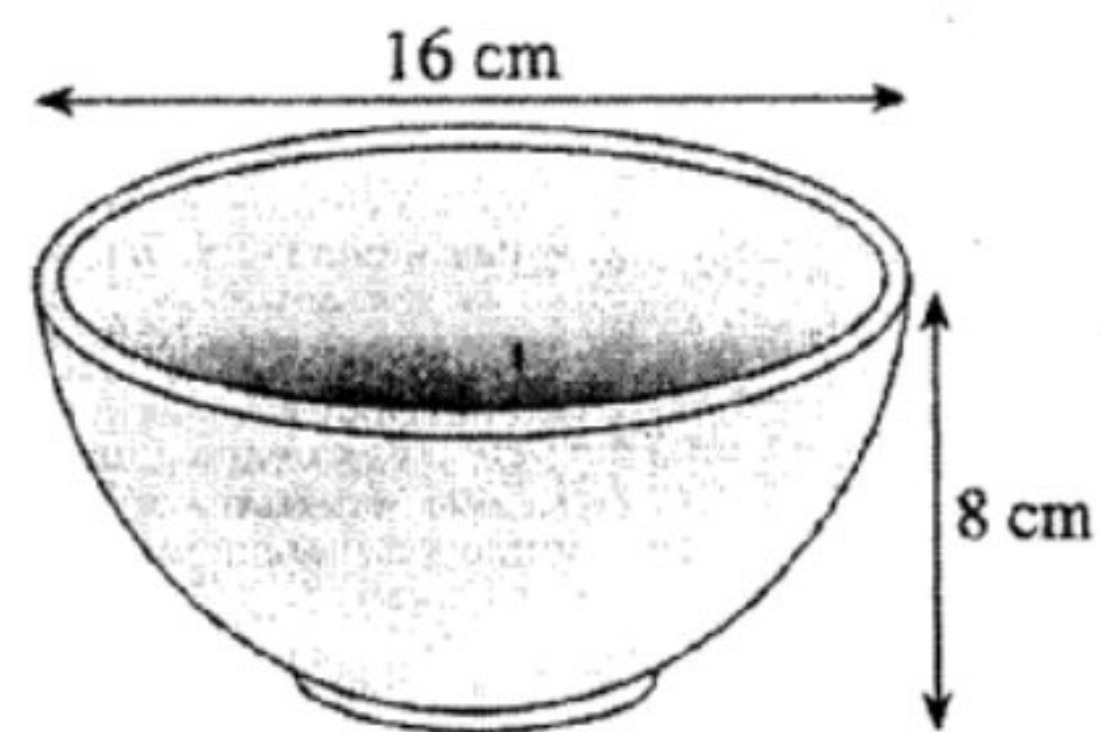


Diagram 8

(i) Prove that $a = \frac{1}{8}$.

(ii) Porridge is poured into the bowl. Calculate the volume of the porridge when the height reaches 6 cm.

[5 marks]

Answer:

15. (a) Given $\log_a 2 = x$ and $\log_a 7 = y$, express $\log_7 \frac{a^3}{196}$ in terms of x and y .

[3 marks]

(b) The content of oxygen gas in a tank decreases from 800 litres to V litres follows the equation

$$V = 800 \left(\frac{9}{10} \right)^x \text{ after } x \text{ minutes. Calculate}$$

(i) the content of oxygen in tank, in litres after 25 minutes,

(ii) the time of maximum use of the oxygen tank in integer if at least 100 litres of oxygen gas must be reserved for emergency use.

[5 marks]

Answer:

END OF QUESTION PAPER

SULIT

NAMA		TINGKATAN	5
------	--	-----------	---

PEPERIKSAAN
ADDITIONAL MATHEMATICS
Kertas 2

TAHUN 2023

3472/2

2 ½ jam

2 jam 30 min

JANGAN BUKA KERTAS PEPERIKSAAN INI SEHINGGA DIBERITAHU

1. *This question paper consists of 14 questions.*
2. *Answer all questions in Section A, any three questions from Section B and any two questions from Section C.*
3. *Write your answers in the spaces provided in the question paper.*
4. *Show your working. It may help you to get marks.*
5. *If you wish to change your answer, cross out the answer that you have done. Then write down the new answer.*
6. *The diagrams provided in the questions are not drawn to scale unless stated.*
7. *The marks allocated for each question and sub-part of a question are shown in brackets.*
8. *You may use a scientific calculator.*
9. *A list of formulae is provided.*
10. *Hand in this question paper to the invigilator at the end of the examination.*

Untuk Kegunaan Pemeriksa			
Kod Pemeriksa:			
Bahagian	Soalan	Markah Penuh	Markah diperoleh
A	1	5	
	2	7	
	3	7	
	4	8	
	5	7	
	6	8	
	7	8	
B	8	10	
	9	10	
	10	10	
	11	10	
C	12	10	
	13	10	
	14	10	
Jumlah		100	

Kertas peperiksaan ini mengandungi 23 halaman bercetak dan 1 halaman tidak bercetak.

3472/2

[Lihat halaman sebelah

SULIT

The following formulae may be helpful in answering the questions. The symbols given are the ones commonly used.

$$1. x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$2. \log_a b = \frac{\log_c b}{\log_c a}$$

$$3. T_n = a + (n-1)d$$

$$4. T_n = ar^{n-1}$$

$$5. S_n = \frac{n}{2}[2a + (n-1)d]$$

$$6. S_n = \frac{a(r^n - 1)}{r - 1} = \frac{a(1 - r^n)}{1 - r}, r \neq 1$$

$$7. z = \frac{X - \mu}{\sigma}$$

$$8. P(X = r) = {}^n C_r p^r q^{n-r}, p + q = 1$$

$$9. {}^n P_r = \frac{n!}{(n-r)!}$$

$$10. {}^n C_r = \frac{n!}{(n-r)!r!}$$

$$11. I = \frac{Q_1}{Q_0} \times 100$$

$$12. \bar{I} = \frac{\sum I_i w_i}{\sum w_i}$$

$$13. \sin^2 A + \cos^2 A = 1$$

$$14. \sec^2 A = 1 + \tan^2 A$$

$$15. \operatorname{cosec}^2 A = 1 + \cot^2 A$$

$$16. \sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$17. \cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$18. \tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$19. \sin 2A = 2 \sin A \cos A$$

$$20. \cos 2A = \cos^2 A - \sin^2 A$$

$$= 2 \cos^2 A - 1$$

$$= 1 - 2 \sin^2 A$$

$$21. \tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

$$22. \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$23. a^2 = b^2 + c^2 - 2bc \cos A$$

$$24. \text{Area of triangle} = \frac{1}{2} ab \sin c$$

SULIT

3472/2

Section A

[50 marks]

Answer **all** questions

1. Solve the following simultaneous equations:

$$2y = -2x - 10$$

and

$$2y^2 + x = 5$$

[5 marks]

Answer:

SULIT

3472/2

2. (a) Given that the length of the two diagonals of a rhombus $PQRS$ is $(2 + \sqrt{3})$ cm and $(3 + \sqrt{48})$ cm respectively. Calculate the area, in cm^2 , of the rhombus $PQRS$. Give your answer in the form of $a + b\sqrt{3}$ where a and b are rational numbers.

[3 marks]

- (b) Given that $\log_a P = \frac{1}{2}(\log_a 48 + \log_a 0.25 - 5 \log_a 3)$, find the value of P .

Hence, find the value of $\log_a P$ when $a = \frac{\sqrt{2}}{3}$.

[4 marks]

Answer:

SULIT

3472/2

3. (a) The second, third and sixth terms of an arithmetic progression are three consecutive terms of a geometric progression.

Find the common ratio of the geometric progression.

[4 marks]

(b)



Diagram 1

Bryan wanted to save money to buy his best friend a gift worth RM925. Diagram 1 shows his savings for the first 3 days. He continued his savings in the form of an arithmetic progression.

Find the amount he saved on the last day when his total savings was enough to buy the gift.

[3 marks]

Answer:

SULIT

3472/2

4. Diagram 2 shows a point Q that moves along the circumference of a circle with centre S . The straight line $2x = y - 3$ is a tangent to the circle at point B and intersects the y -axis at point A .

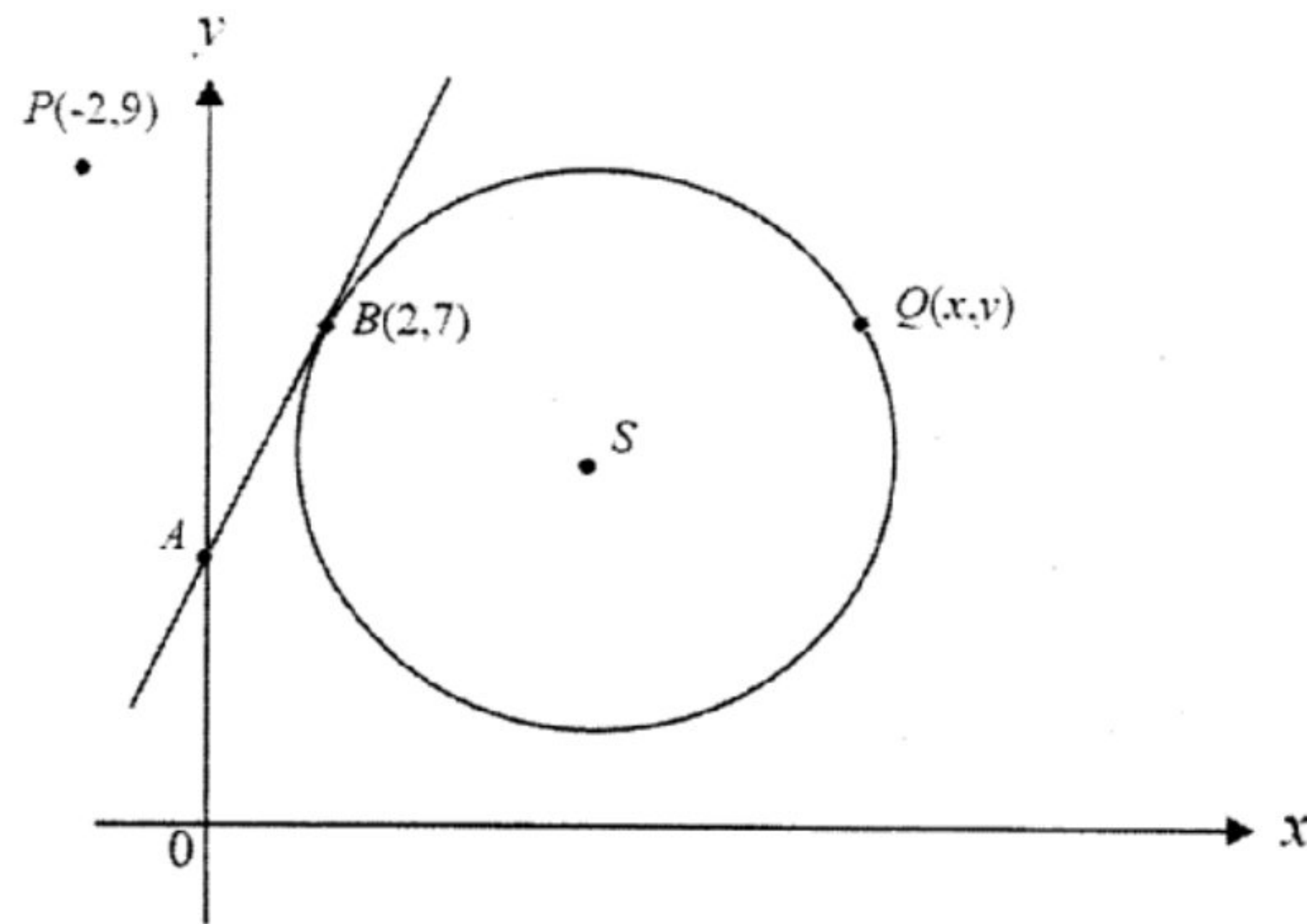


Diagram 2

- (a) Point S is the image of point P under a reflection at the line $2x = y - 3$. Points P , B and S are collinear. Find the equation of locus of point Q . [4 marks]
- (b) If the straight line BS is extended to point N , such that $3BN = 4SN$, calculate the area of quadrilateral $OABN$. [4 marks]

Answer:

5. In the Diagram 3, the circle with centre O , passes through L and P . It is given that the radius of the circle is 7 cm and $OMNQ$ is a rectangle with width 3.5 cm. [Use $\pi = 3.142$]

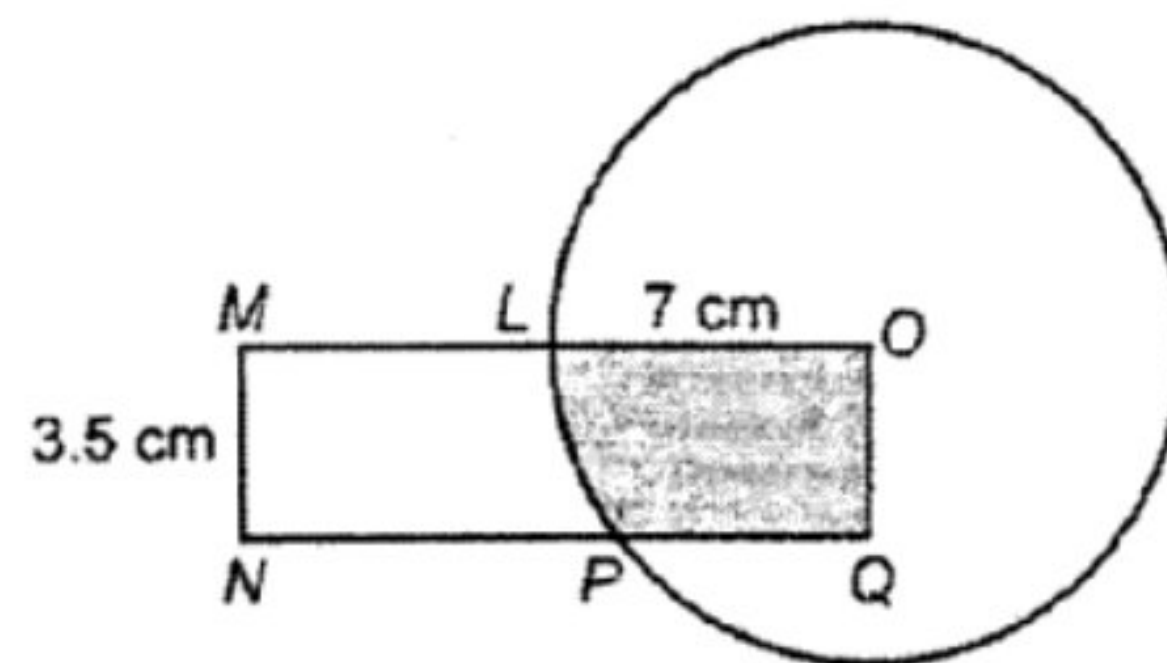


Diagram 3

Find

- (a) $\angle POL$, in radians,

[2 marks]

- (b) PQ , in cm,

[2 marks]

- (c) the area of the shaded region $LOQP$, in cm^2 .

[3 marks]

Answer:

6. Diagram 4 shows two curves $y^2 = x$ and $y^2 = 4 - x$ are intersecting at point Q . The straight line PQ is parallel to the x -axis.

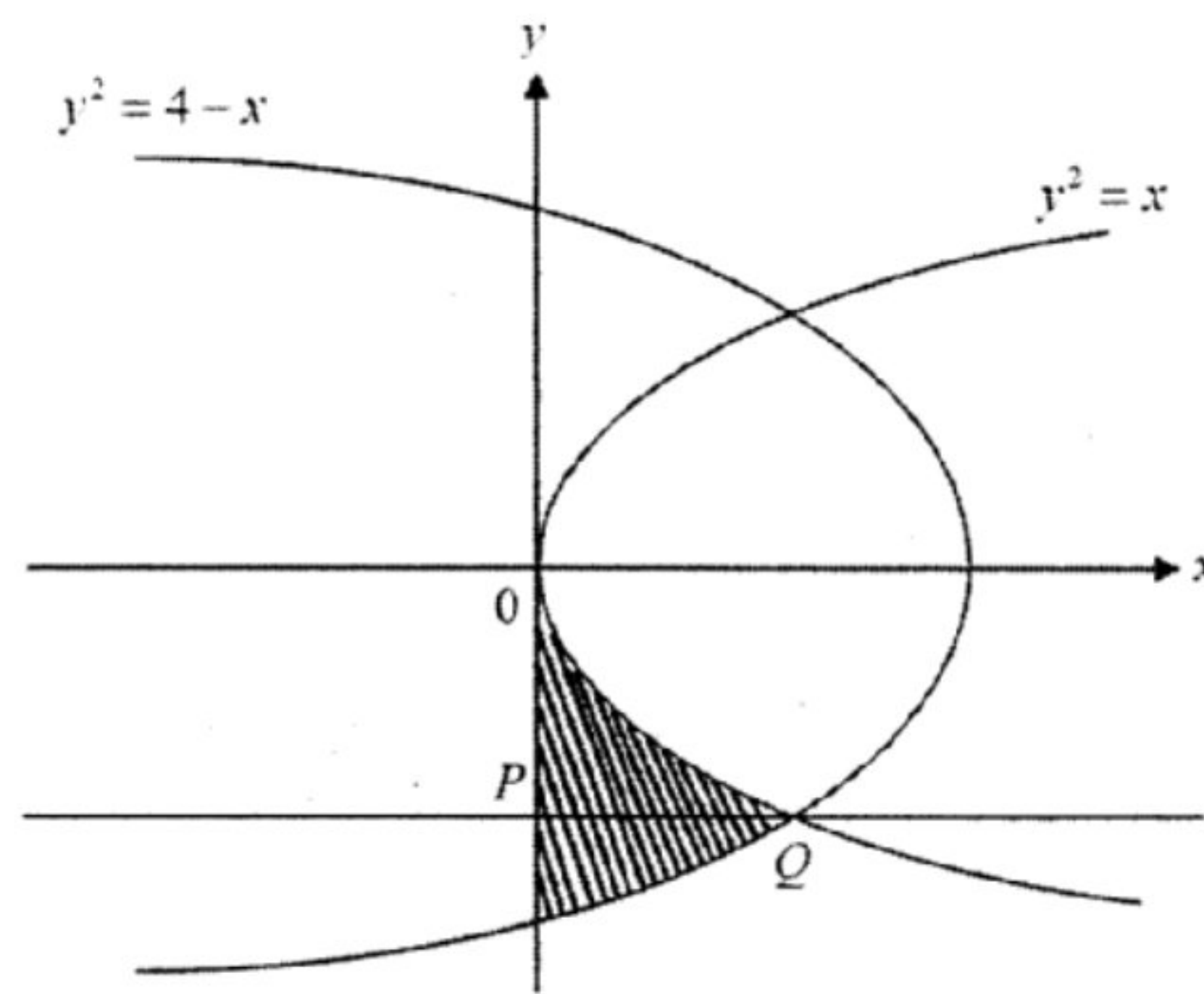


Diagram 4

Find

- (a) the equation of the straight line PQ ,

[2 marks]

- (b) the area of the shaded region,

[3 marks]

- (c) the volume generated when the region bounded by the curves $y^2 = x$ and $y^2 = 4 - x$ is revolved 180° about the x -axis.

[3 marks]

Answer:

7. It is given that one of the roots of quadratic function $f(x) = \frac{1}{3}(x^2 - 4px + 9p)$ is one third of another root when $f(x) = 0$ where p is a constant and $p \neq 0$.

(a) Find the value of p .

[3 marks]

(b) Hence, find the function $f(x)$, in the general form, when the graph $y = f(x)$ is shifted to the left by 5 units and vertically upwards by 6 units.

[5 marks]

Answer:

Section B

[30 marks]

Answer any **three** questions from this section

8. Table 1 shows the values of two variables, x and y obtained from an experiment. Variables x and y are related by the equation $y = \frac{q}{p^{2x}}$, where p and q are constants.

x	1	2	3	4	5	6	7
y	33.11	27.54	21.88	19.05	16.22	13.18	r

Table 1

- (a) Plot the graph of $\log_{10} y$ against x by using the scale of 2 cm to 1 unit on the x -axis and 2 cm to 0.1 unit on the $\log_{10} y$ -axis.

[4 marks]

- (b) Using the graph in (a), find the value of

- (i) p
- (ii) q
- (iii) r

[6 marks]

Answer:

9. Diagram 5 shows the locations of bookshop, computer shop, park, shopping mall and public library in a town.

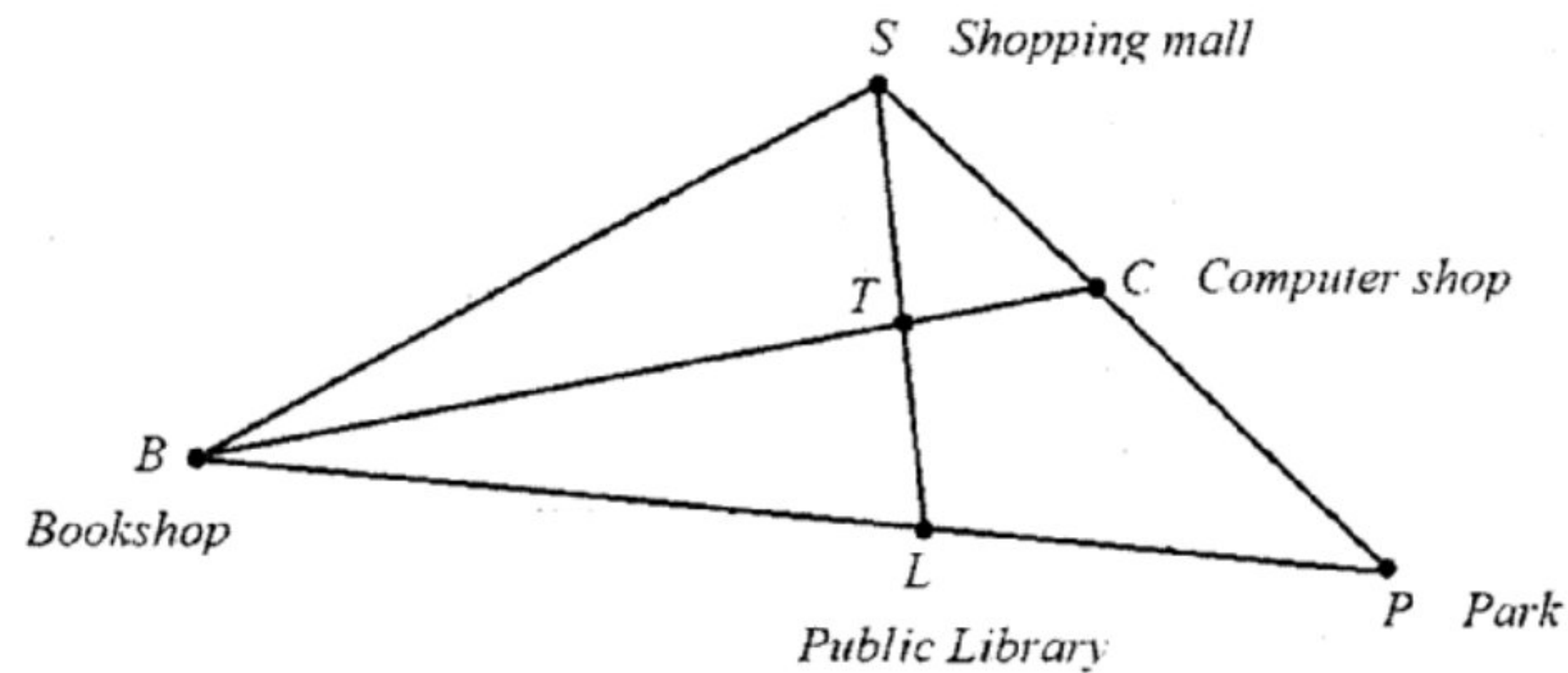


Diagram 5

The vector from the bookshop to the public library is $12\underline{x}$ and the vector from the bookshop to the shopping mall is $16\underline{x} + 10\underline{y}$. T is the intersection junction between the straight roads BC and LS . Given the distance of the public library from the bookshop is 3 times the distance of the public library from the park. The computer shop is located in the middle between the shopping mall and the park on the straight road PS .

- (a) Find the vector, in terms of \underline{x} and \underline{y} , from

(i) the public library to the shopping mall.

[2 marks]

(ii) the bookshop to the computer shop.

[3 marks]

(iii) Given $\overrightarrow{BT} = \lambda \overrightarrow{BC}$ and $\overrightarrow{LT} = k \overrightarrow{LS}$, find $BT : TC$.

[5 marks]

Answer:

10. (a) Diagram 6 shows a farm that is built by a cow farmer which can occupy the maximum number of cows.

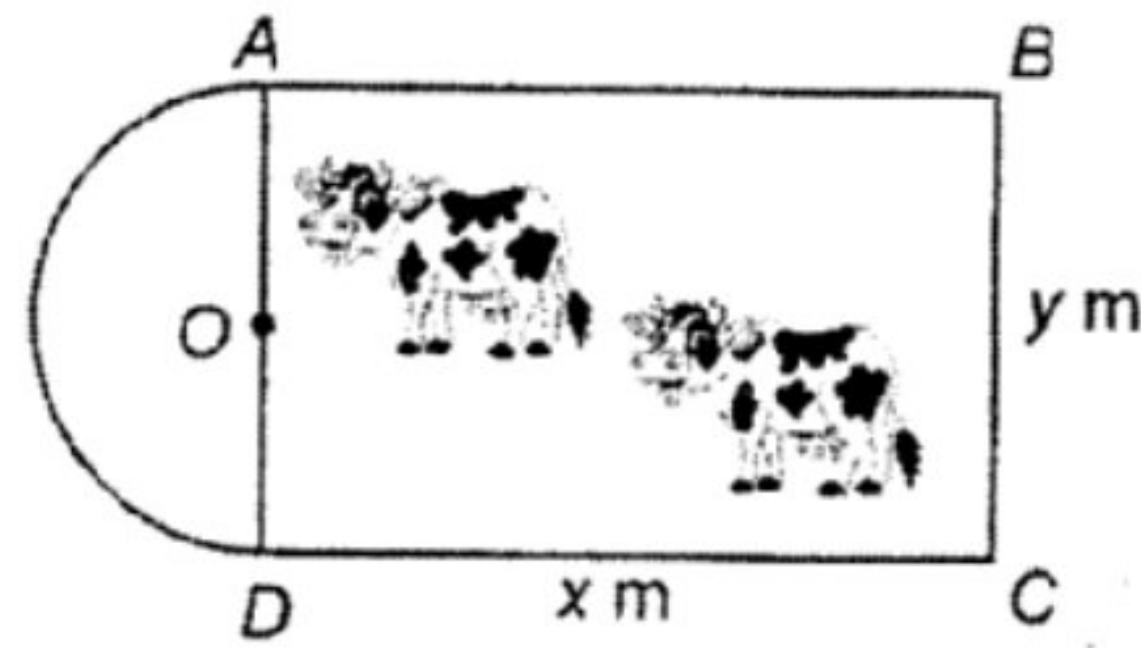


Diagram 6

The farm is made up of a rectangle with a length of x m, and a width of y m, and a semicircle with centre O . Given that the perimeter of the whole diagram is 80 m.

[Use $\pi = \frac{22}{7}$]

- (i) Find the value of x and of y , in m, when the total area of the farm is maximum.

[4 marks]

- (ii) Hence, find the maximum area of the farm.

[2 marks]

- (b) Given that $v = \frac{\sqrt{x} + 2x}{x^2 - 1}$, find $\frac{dv}{dx}$. Then, find the approximate value for $y = \frac{\sqrt{4.02} + 2(4.02)}{(4.02)^2 - 1}$.

[4 marks]

Answer:

SULIT

3472/2

SULIT

3472/2

11. Diagram 7 shows triangles ABC and ADE . It is given that the area of triangle ABC is $\frac{\sqrt{6}+2}{2} \text{ cm}^2$,

$BC = (\sqrt{6} - 2) \text{ cm}$, $DE = \sqrt{24} \text{ cm}$ and BC is parallel to DE .

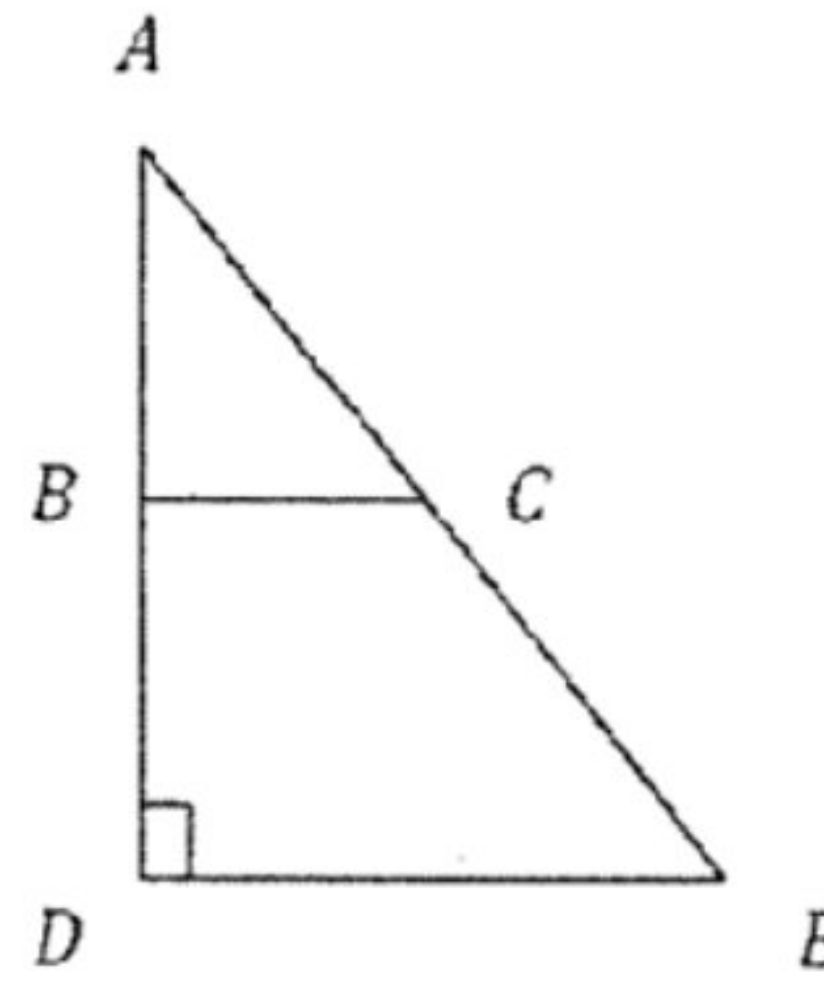


Diagram 7

(a) Find the length of BD in the form of $(m + n\sqrt{6})$.

[6 marks]

(b) (a) Given $3^{x+3} + 18(3^x) + 3^{x+2} = p(3^{x+q})$ such that p and q are positive integers. Find the value of $p + q$.

[2 marks]

(b) If $4^a = b$, express $64^a - 16^{-a}$ in terms of b .

[2 marks]

Answer:

SULIT

3472/2

Section C

[20 marks]

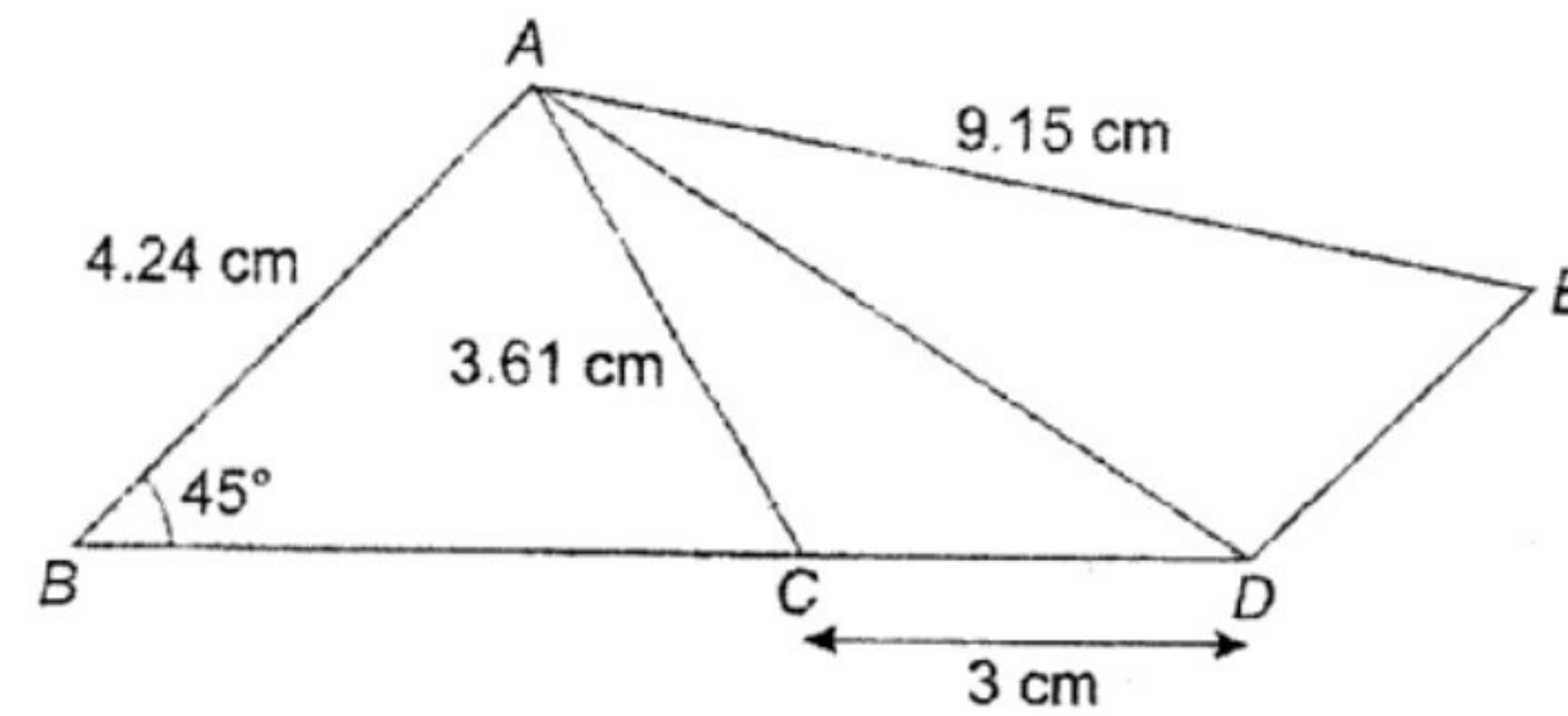
Answer any **two** questions from this section12. Diagram 8 shows a quadrilateral $ABDE$.

Diagram 8

Given that $\angle ACD$ is an obtuse angle and the area of the triangle ADE is 14.5 cm².

Calculate

(a) (i) $\angle ACB$,(ii) the length, in cm, of AD .(iii) the shortest distance, in cm, from point D to straight line AE .

[7 marks]

(b) (i) Sketch a triangle $AC'D$ which has a different shape from triangle ACD such that $CD = C'D$ and $\angle CAD = \angle C'AD$.(ii) Hence, calculate the area, in cm², of triangle DCC' .

[3 marks]

Answer:

13. Table 2 shows the price indices and the percentage of usage of four components, A , B , C and D in the production of a scanner.

Component	Price indices for the year 2021 based on the year 2019	Percentage of usage (%)
A	128	30
B	h	10
C	135	40
D	133	20

Table 2

- (a) Calculate the price of component A in the year 2019 if its price in the year 2021 is RM32. [2 marks]
- (b) Given that the composite index for the production cost of a scanner in the year 2021 based on the year 2019 is 128.5, find the value of h . [3 marks]
- (c) From the year 2021 to the year 2025, the prediction to the prices of component B will be increased by 12%, the price of component C will be decreased by 10% where the prices of component A and D will remain unchanged.
- (i) Find the composite index for the production cost of a scanner in the year 2025 based on the year 2019.
- (ii) If the production cost of a scanner in the year 2019 is RM116, calculate the corresponding production cost of a scanner in the year 2025. [5 marks]

Answer:

SULIT

14. The STEM club of SM Lodge will be organizing a trip to University of Malaysia Sarawak. The number of students who will be joining the trip is limited to the following constraints:

- I The total number of students who join the trip is at most 80 persons.
- II The number of Form 5 students exceed the number of Form 4 students by not more than 20 persons.
- III The number of Form 4 students is not more than three times the number of Form 5 students.

(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 10 units on both axes, construct and shade the region R which satisfy all the constraints above.

[3 marks]

(c) Using your graph in (b), find

(i) the maximum number of Form 5 students,

(ii) the maximum collection of fees, in RM, from all the students who join the trip if every Form 4 students pays RM20 and every Form 5 students pays RM25.

[4 marks]

Answer:

SULIT

3472/2

END OF QUESTION PAPER