BENGKEL
TEKNIK MENJAWAB SOALAN MATEMATIK SPM 2017

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Answer :

Section A

1. The Venn diagram in the answer space shows set P, set Q and set R such that the universal set

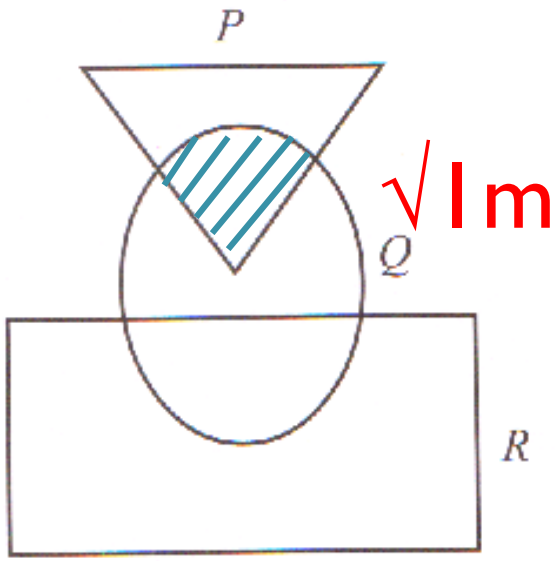
   $\xi = P \cup Q \cup R$

   On the diagram in the answer space,

   shade the set

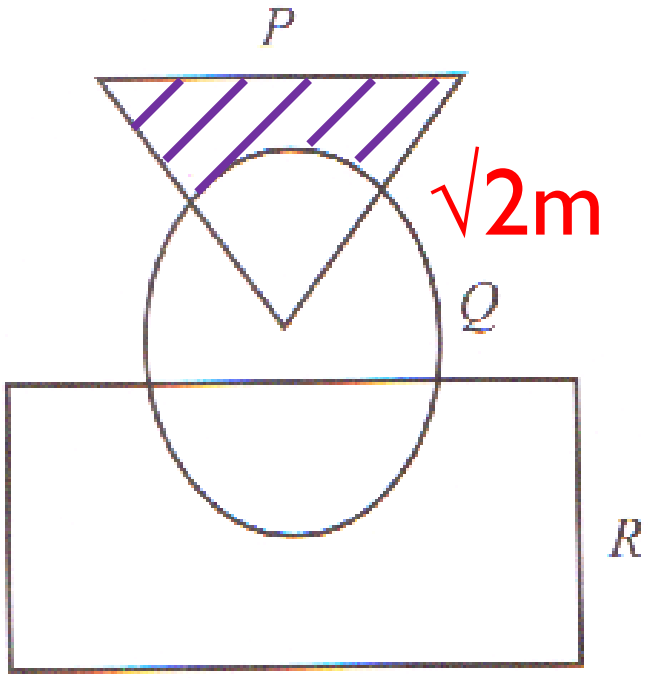
   (a) $P \cap Q$

   Answer :



√ I m

(b) $P \cap (Q' \cup R)$



2. Calculate the value of *m* and *n* that satisfy the following simultaneous linear equations.

$$m + 3n = 12$$
$$\frac{2}{3}m - n = 2$$

Answer : Substitution method

$m + 3n = 12$ - - - - - - - - - - - - (1)

$\frac{2}{3}m - n = 2$ - - - - - - - - - - - - - - (2)

From (1)

$m = 12 - 3n$ - - - - - - - - - (3)

Substitute (3) into (2)

$$\frac{2}{3}(12 - 3n) - n = 2$$

$$\frac{2}{3}(12-3n)-n=2$$

$$8-2n-n=2$$

$$-3n=-6 \quad \surd \text{ l m}$$

$$n=\frac{-6}{-3}$$

$$n=2 \surd \text{ l m}$$

Substitute n = 2 into (3) :

m = 12 – 3(2)

m =6 $\surd$ l m

Equalise terms method :

$m + 3n = 12$ - - - - - - - - - - - - (1)

$\frac{2}{3}m - n = 2$ - - - - - - - - - - - - - - (2)

From (1)

$\frac{2}{3}(m + 3n) = \frac{2}{3}(12)$

$\frac{2}{3}m + 2n = 8$ ---------(3) √ 1 m

$\frac{2}{3}m - n = 2$ ---------(2)

(3) – (2) :

$3n = 6$ √ 1 m

$n = 2$ √ 1 m

Substitute n = 2 into (1) :

$m + 3n = 12$

$m + 3(2) = 12$

$m = 12 - 6$

$= 6$ √1m

Matrix method :

$m + 3n = 12$

$\frac{2}{3}m - n = 2$

$$\begin{pmatrix} 1 & 3 \\ \frac{2}{3} & -1 \end{pmatrix}\begin{pmatrix} m \\ n \end{pmatrix} = \begin{pmatrix} 12 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} m \\ n \end{pmatrix} = \frac{1}{(1)(-1)-(3)\left(\frac{2}{3}\right)}\begin{pmatrix} -1 & -3 \\ -\frac{2}{3} & 1 \end{pmatrix}\begin{pmatrix} 12 \\ 2 \end{pmatrix}$$ √2m

$$\begin{pmatrix} m \\ n \end{pmatrix} = \frac{1}{-3}\begin{pmatrix} (-1)(12)+(-3)(2) \\ \left(-\frac{2}{3}\right)(12)+(1)(2) \end{pmatrix}$$

$$= \frac{1}{-3}\begin{pmatrix} -18 \\ -6 \end{pmatrix}$$

$$= \begin{pmatrix} 6 \\ 2 \end{pmatrix}$$

$\therefore \quad m = 6, n = 2$

√ Im √ Im

3. Solve the quadratic equation :

$4(x + 4) = 9 + 16x$

Answer :

$$4x(x+4)=9+16x$$

$$4x^2+16x=9+16x$$

$$4x^2+16x-16x-9=0$$

$$4x^2-9=0 \quad \sqrt{\text{Im}}$$

2x	3	6x	
2x	- 3	- 6x	(+)
$4x^2$	-9	0	

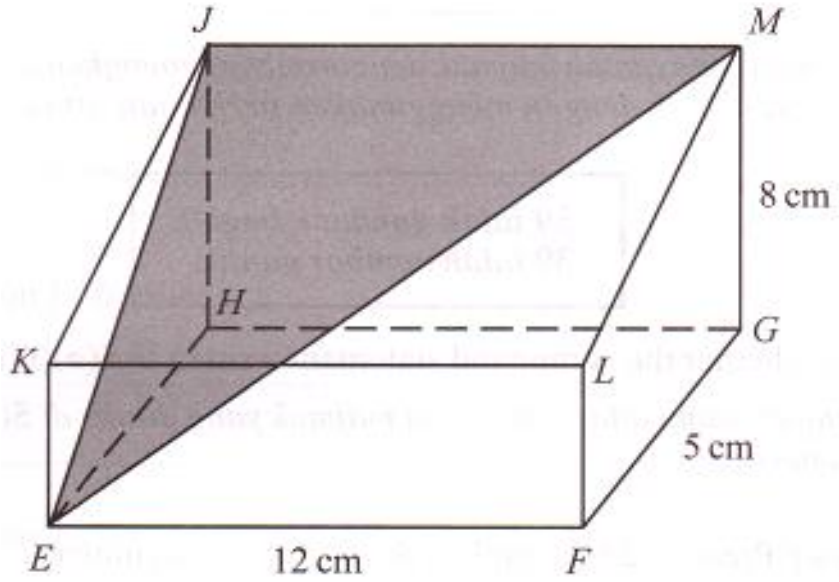
$(2x - 3)(2x + 3) = 0$ √ Im

$2x - 3 = 0 \quad , \quad 2x + 3 = 0$

$2x = 3 \, , \qquad 2x = -3$

$x = \frac{3}{2}$, √ Im $\quad x = -\frac{3}{2}$ √ Im

4. Diagram 4 shows a right prism with a rectangular base *EFGH* on a horizontal plane. Trapezium *FGML* is the uniform cross section of the prism.



(a) Name the angle between the plane *JEM* and the plane *JHGM*.

(b) Calculate the angle between the plane *JEM* and the plane *JHGM*.

Answer :

(a) $\angle EJH$ *or* $\angle HJE$ √ 1 m

(b) $Tan\,\theta = \frac{5}{8}$ √ 1 m

$\theta = 32°$ √ 1 m

5. (a) (i) Write a compound statement by combining the two statements given below using the word ‘or’.

39 is a multiple of 9. 39 is an odd number.

Answer :

39 is a multiple of 9 or 39 is an odd number $\sqrt{}$ 1 m

(ii) State whether the compound statement written in 5 (a)(i) is true or false.

Answer :

True $\sqrt{}$ 1 m

(b) Write down premise 2 to complete the following argument:

Premise 1 : If $x^n + 4$ is a quadratic expression, then $x = 2$.

Premise 2 : $x \neq 2$ √Im

Conclusion : $x^n + 4$ is not a quadratic expression.

(c) Write down two implications based on the following statement :

> A number is a prime number if and only if it is only divisible by 1 and itself

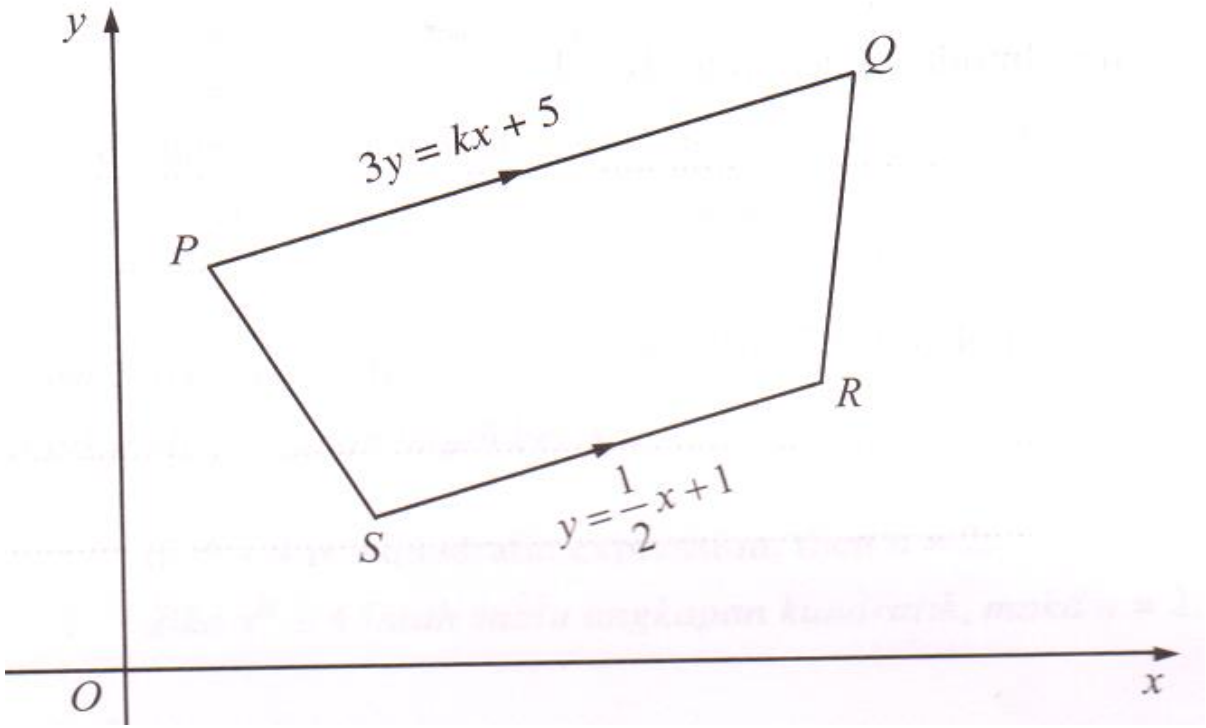
Implication 1 : If a number is a prime number, then it is divisible by 1 and itself

√ 1 m

Implication 2 : If a number is divisible by 1 and itself then it is a prime number.

√ 1 m

6. In Diagram 6, *PQRS* is a trapezium drawn on a Cartesian plane. *PQ* is parallel to *SR* and *O* is the origin. The equation of the straight line *PQ* is $3y = kx + 5$ and the equation of the straight line *SR* is $y = \frac{1}{2}x + 1$



Find

(a) the value of k

(b) the x – intercept of the straight line PQ.

Answer :

(a) $\frac{k}{3} = \frac{1}{2}$ √2m

$k = \frac{3}{2}$ √1m

(b) $3y = \frac{3}{2}x + 5$

$3(0) = \frac{3}{2}x + 5$ √1m

$-\frac{3}{2}x = 5$

$x = (5)\left(-\frac{2}{3}\right)$

$= -\frac{10}{3}$ √1m

7. Diagram 7 shows a solid formed by joining a cuboid and a half cylinder at the rectangular plane *EFGH*.

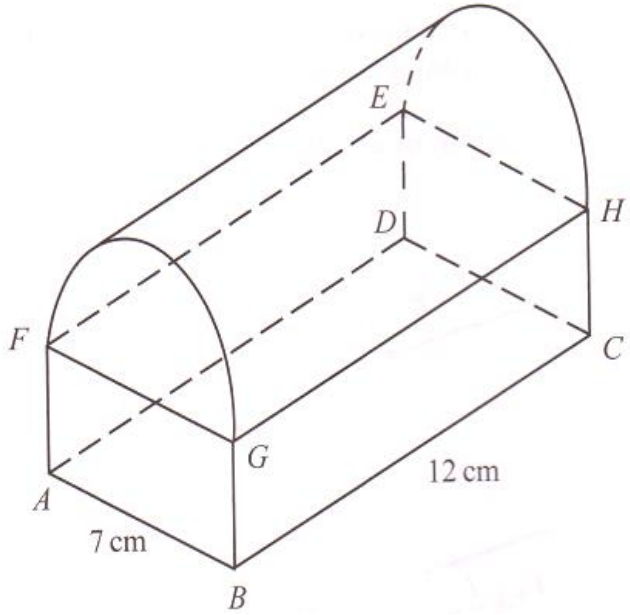


Diagram 7

The volume of the solid is $483\ cm^3$

Using $\pi = \frac{22}{7}$, calculate the height, in cm, of the cuboid.

Answer :

Combined volume = Volume of half cylinder + Volume of cuboid

$$483 = \frac{1}{2} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times 12 + 7 \times 12 \times h \quad \sqrt{1m} \quad \sqrt{1m} \quad \sqrt{1m}$$

$483 = 462 + 84h$

$84h = 483 - 231$

$84h = 252$

$h = 3\ cm$ $\sqrt{1m}$

8. (a) It is given that $M\begin{pmatrix} 3 & 2 \\ 6 & 5 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, where M is a 2 x 2 matrix.

Find M.

(b) Write the following simultaneous linear equations as matrix equation :

$$3x + 2y = 3$$

$$6x + 5y = 9$$

Hence, by using matrix method, calculate the value of x and of y.

Answer :

(a) $M = \dfrac{1}{(3)(5)-(2)(6)}\begin{pmatrix} 5 & -2 \\ -6 & 3 \end{pmatrix}$

$= \dfrac{1}{3}\begin{pmatrix} 5 & -2 \\ -6 & 3 \end{pmatrix}$

$= \begin{pmatrix} \dfrac{5}{3} & -\dfrac{2}{3} \\ -2 & 1 \end{pmatrix}$ √2m

(b) $\begin{pmatrix} 3 & 2 \\ 6 & 5 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \\ 9 \end{pmatrix}$ √ I m

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{3}\begin{pmatrix} 5 & -2 \\ -6 & 3 \end{pmatrix}\begin{pmatrix} 3 \\ 9 \end{pmatrix}$$ √ I m

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{3}\begin{pmatrix} (5)(3)+(-2)(9) \\ (-6)(3)+(3)(9) \end{pmatrix}$$

$$= \frac{1}{3}\begin{pmatrix} -3 \\ 9 \end{pmatrix}$$

$$= \begin{pmatrix} -1 \\ 3 \end{pmatrix}$$

$\therefore x = -1, \quad y = 3$

√ I m √ I m

9. In Diagram 9, *PMQL* is a sector of a circle centre *P* and *OPRQ* is a semicircle with centre *O*.

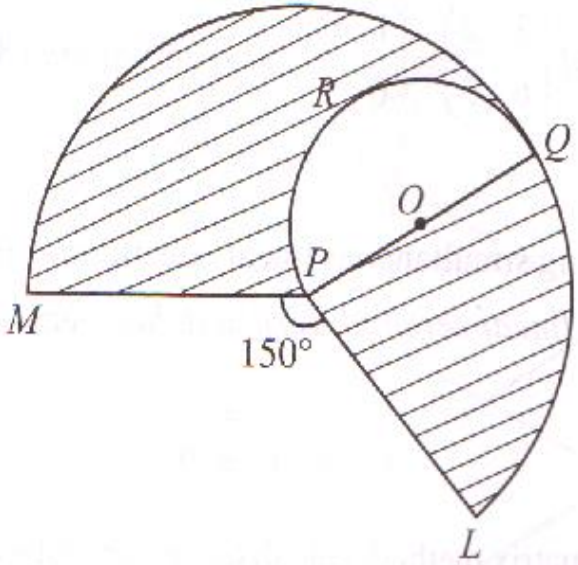


Diagram 9

It is given that *MP* = 14 cm.

Use $\pi = \frac{22}{7}$, calculate

(a) the perimeter, in cm, of the whole diagram.

(b) the area, in cm^2, of the shaded region.

Answer :

(a) Perimeter of the whole diagram

$$= \frac{210}{360} \times 2 \times \frac{22}{7} \times 14 + 14 + 14 \quad \sqrt{1m}$$

$$= \frac{238}{3} \quad \sqrt{1m}$$

(b) Area of shaded region :

$$= \frac{210}{360} \times \frac{22}{7} \times (14)^2 - \frac{180}{360} \times \frac{22}{7} \times (7)^2 \quad \sqrt{1m}$$

$$= \frac{847}{3} \quad \sqrt{1m}$$

10. Table 10 shows the names of participants from the Science Society and Mathematics Society attending a camping programme.

	Boys	**Girls**
Science Society	Ali Bob	Nora
Mathematics Society	Kumar	Rose Suzi Lina

Table 10

Two participants are required to give speeches at the end of the programme.

(a) A participant is chosen at random from the Mathematics Society and then another from participant is chosen at random also from Mathematics Society.

(i) List all the possible outcomes of the event is this sample space.

(ii) Hence, find the probability that a boy and a girl also chosen.

Answer :

(a) {(Kumar, Rose), (Kumar, Suzi),
(Kumar, Lina), (Rose, Suzi), (Rose, Lina),
(Suzi, Lina), (Rose, Kumar), (Suzi, Kumar)
(Lina, Kumar), (Suzi, Rose), (Lina, Rose)
(Lina, Suzi)} √1m

(b) {(Kumar, Rose), (Kumar, Suzi),
(Kumar, Lina), (Rose, Kumar),
(Suzi, Kumar), (Lina, Kumar)} √1m

$$\text{Probability} = \frac{6}{12}$$

$$= \frac{1}{2}$$ √1m

(b) A participant is chosen at random from the boys group and then another participant is chosen at random from the girls group.

(i) List all the possible outcomes of the event in this sample space.

(ii) Hence, find the probability that both participants chosen are from Science Society.

Answer :

(b)(i) {(Ali, Nora), (Ali, Rose), (Ali, Suzi), (Ali, Lina)
Bob, Nora), (Bob, Rose), (Bob, Suzi), (Bob, Lina)
Kumar, Nora), (Kumar, Rose), (Kumar, Suzi),
(Kumar, Lina)}

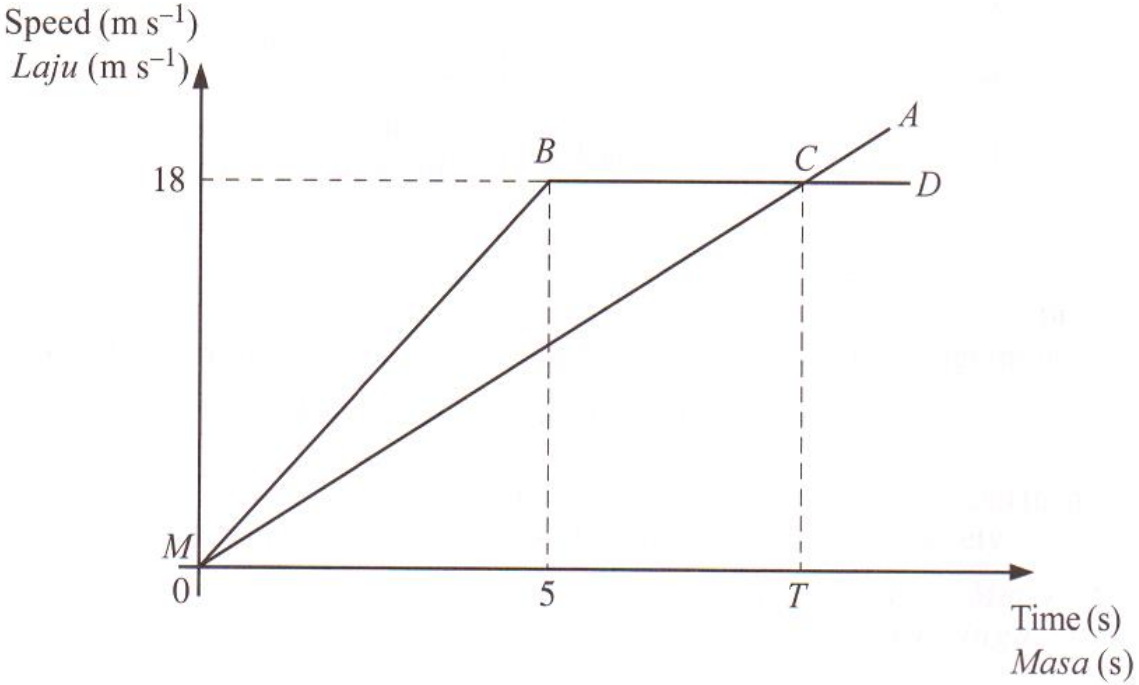
√1m

(b)(ii) {(Ali, Nora), (Bob, Nora)}√1m

$$\text{Probability} = \frac{2}{12}\surd 1\text{m}$$

$$= \frac{1}{6}$$

11. Diagram 11 shows the speed – time graphs of the movement of two particles, *P* and *Q*, for a period of *T* seconds. The graph *MA* represents the movement of *P* and the graph *MBCD* represents the movement of *Q*. Both particles start at the same point and move along the same route.



(a) State the uniform speed, in of particle Q

Answer : 18 √ 1 m

(b) Calculate the rate of change of speed, in ms^{-2} , of particle Q in the first 5 seconds.

Answer : $= \frac{18-0}{5-0}$ √ 1 m

$= \frac{15}{8}$ √ 1 m

(c) At T seconds, the difference between the distance travelled by P and Q is 27 m.

Calculate the value of T.

Answer :

$$\frac{1}{2}\times\left[T+\left(T-5\right)\right]\times 18-\frac{1}{2}\times T\times 18=27 \quad \sqrt{}\text{Im}$$

$\sqrt{}$Im

$$18T-45-9T=27$$

$$9T=72$$

$$T=8 \quad \sqrt{}\text{Im}$$

Section B [48 marks]

Answer any four questions from this section.

12.(a) Complete Table 12 in the answer space, for the equation $y = -x^3 + 3x + 1$ by writing down the values of y when $x = -2$ and $x = 0$.

Answer :

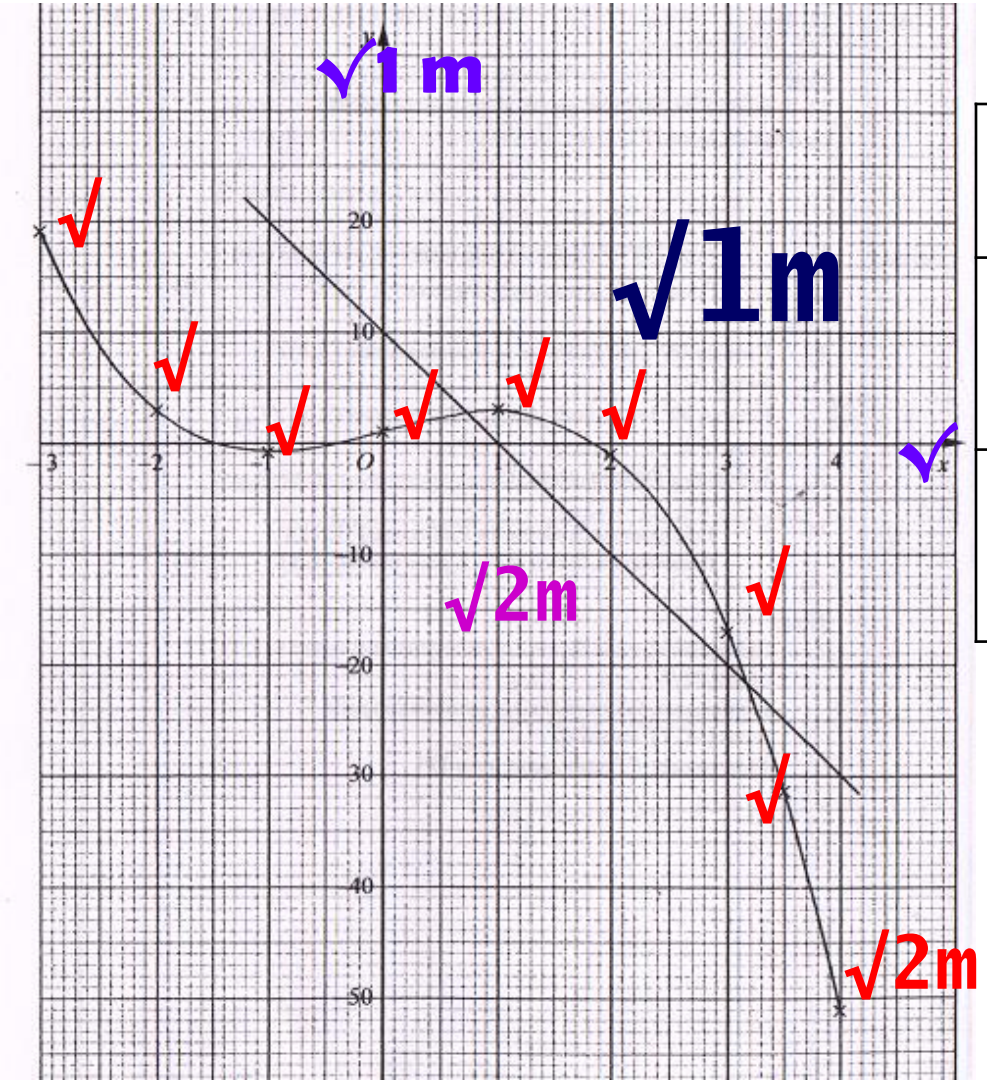
$y = -x^3 + 3x + 1$

x	-3	-2	-1	***0***	***1***	***2***	***3***	***3.5***	***4***
y	*19*	3	-1	1	*3*	-1	-17	-31.4	-51

√ Im √ Im

(b) By using a scale of 2 cm to 1 unit on the x- axis and 2 cm to 10 units on y- axis, draw the graph of $y = -x^3 + 3x + 1$ for $-3 \le x \le 4$ and $-51 \le y \le 19$.

[4 marks]



Uniform scale	√1m
All points plotted correctly	√2m
Scale and all point plotted correctly	√1m

(c) From the graph, find

(i) the value of y when $x = -2.5$

(ii) the value of x when $y = -10$ [2 marks]

Answer :

(i) $y = 9$ √ 1m [$8 \leq y \leq 10$]

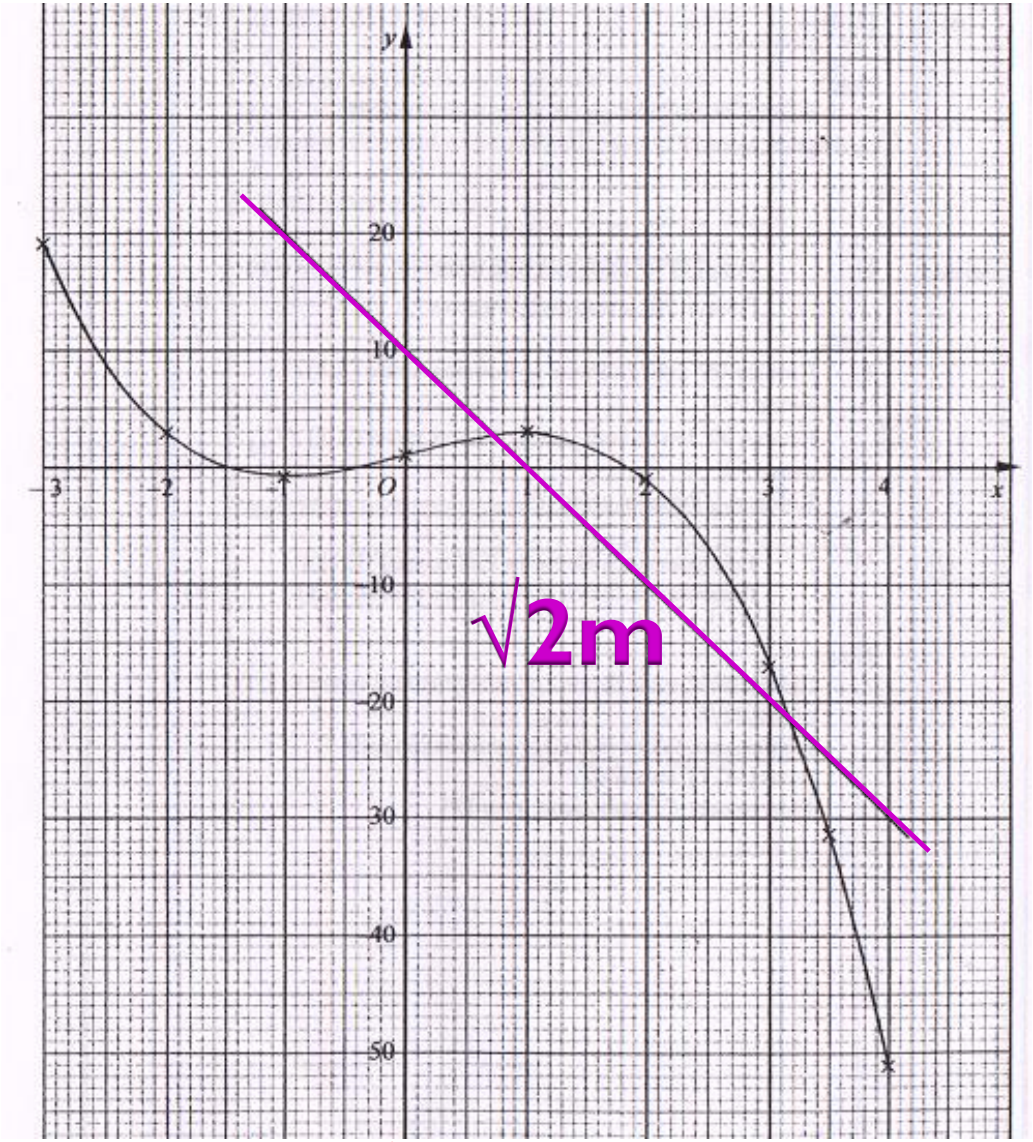
(ii) $x = 2.7$ √ 1m [$2.6 \leq x \leq 2.8$]

(d) Draw a straight line on the graph to find the values of x which satisfy the equation $-x^3+13x-9=0$ for $-3\le x\le 4$ and $-51\le y\le 19$.

Answer :

y	$-x^3$	$3x$	1
0	$-x^3$	$13x$	-9
y	0	$-10x$	10

Equation : $y=-10x+10$



$x = 0.7$ √1m $[\,0.6 \le x \le 0.8\,]$

$x = 3.2$ √1m $[\,3.1 \le x \le 3.3\,]$

13.(a)Diagram 13.1 shows point B and a straight line drawn on a Cartesian plane.

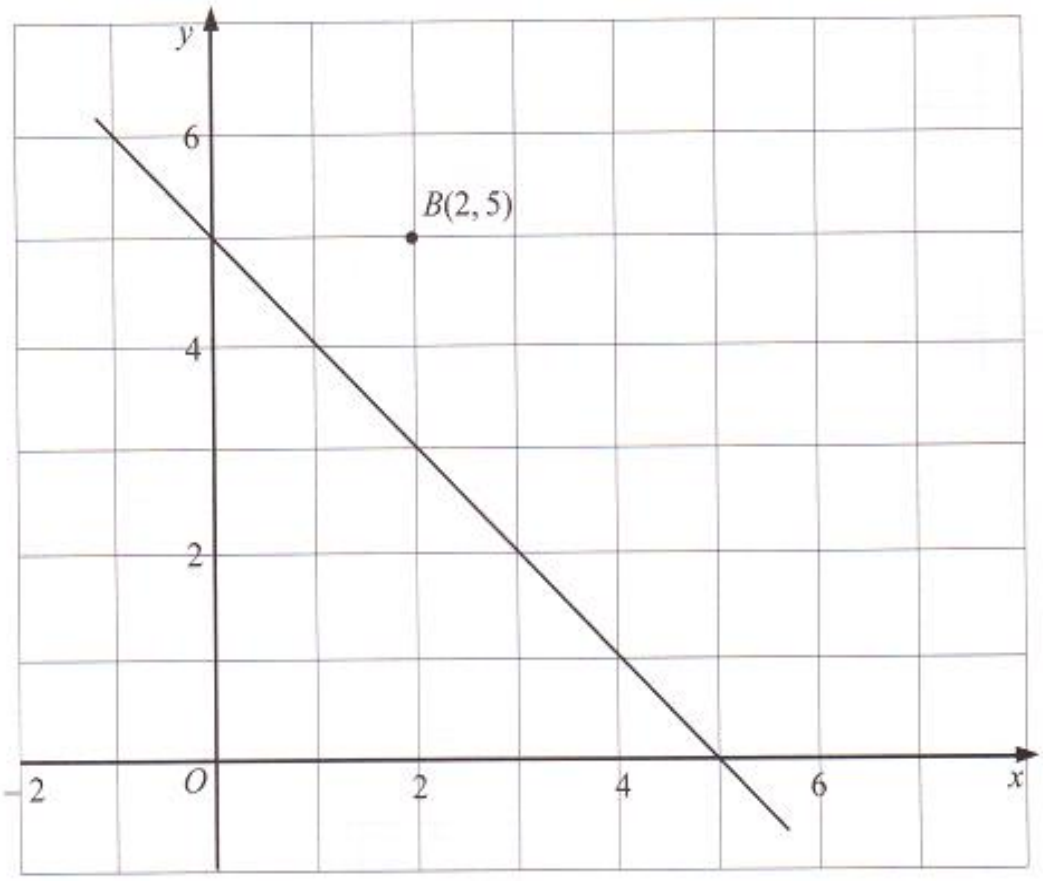


Diagram 13.1

Transformation T is translation $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$

Transformation R is reflection at the line $y = x + 5$

State the coordinates of the image of point B under each of the following transformation:

(i) T

(ii) TR [3 marks]

Answer :

(i) $B(2, 5) \xrightarrow{T} B'(4, 2)$ √ 1 m

(ii) $B(2, 5) \xrightarrow{R} B'(0, 3) \xrightarrow{T} B''(2, 0)$

√ 1 m √ 1 m

(b) Diagram 13.2 shows trapezium *ABCD* and trapezium, *FCDE* drawn on a Cartesian Plane.

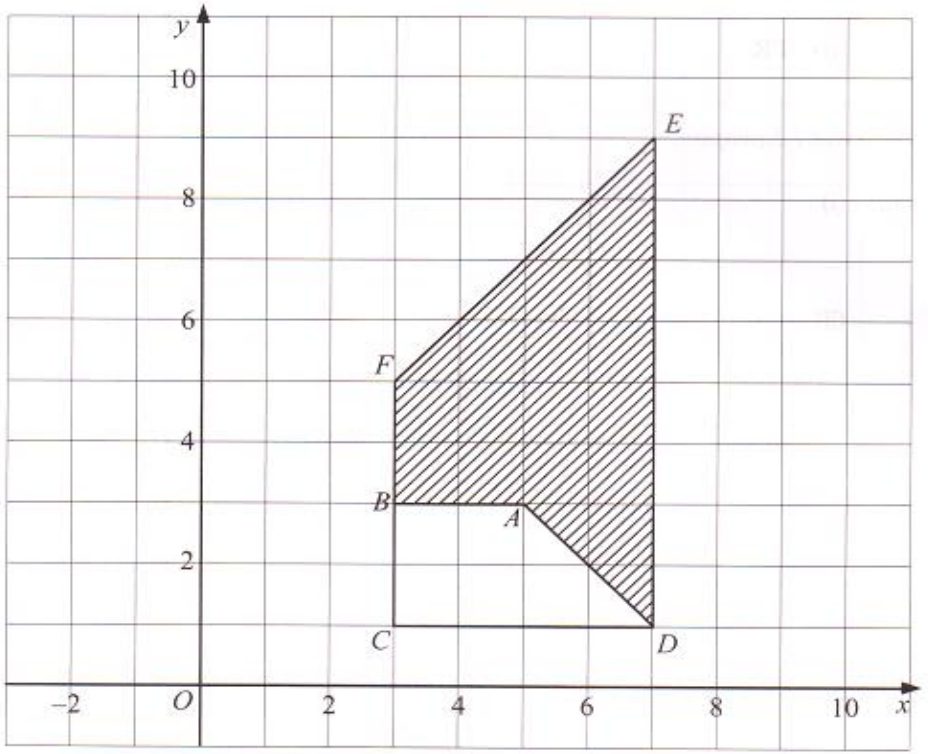


Diagram 13.2

(i) *FCDE* is the image of *ABCD* under the combined transformation *VU*. Describe, in full the transformation :

(a) *U*

(b) *V*

Answer :

U – Rotation 90º anticlockwise about the centre C(3, 1).

√1m √1m √1m

V – Enlargement at the centre $(-1, 1)$ with scale factor of 2

√1m √1m √1m

(ii) It is given that *ABCD* represent the region of area 60 m^2

Calculate the area, in m^2 , of the region represented by the shaded region. [9 marks]

Answer :

$= (60 \times 2^2) - 60$

√1m √1m

$= 180\ m^2$

√1m

14. Diagram 14 shows the number of books read by a group of 24 students in a reading programme in the year 2009.

35	41	50	26	27	27
22	31	33	40	45	23
24	35	30	38	39	36
44	34	28	29	30	35

Diagram 14

(a) Based on the data on Diagram 14, complete Table 14 in the answer space.

[4 marks]

Class interval	Frequency	Midpoint
22 – 26	4	24
27 – 31	7	29
32 – 36	6	34
37 – 41	4	39
42 – 46	2	44
47 – 51	1	49

√1m √2m √1m

Table 14

(b) State the modal class [1 mark]

Answer :

27 – 31 √1m

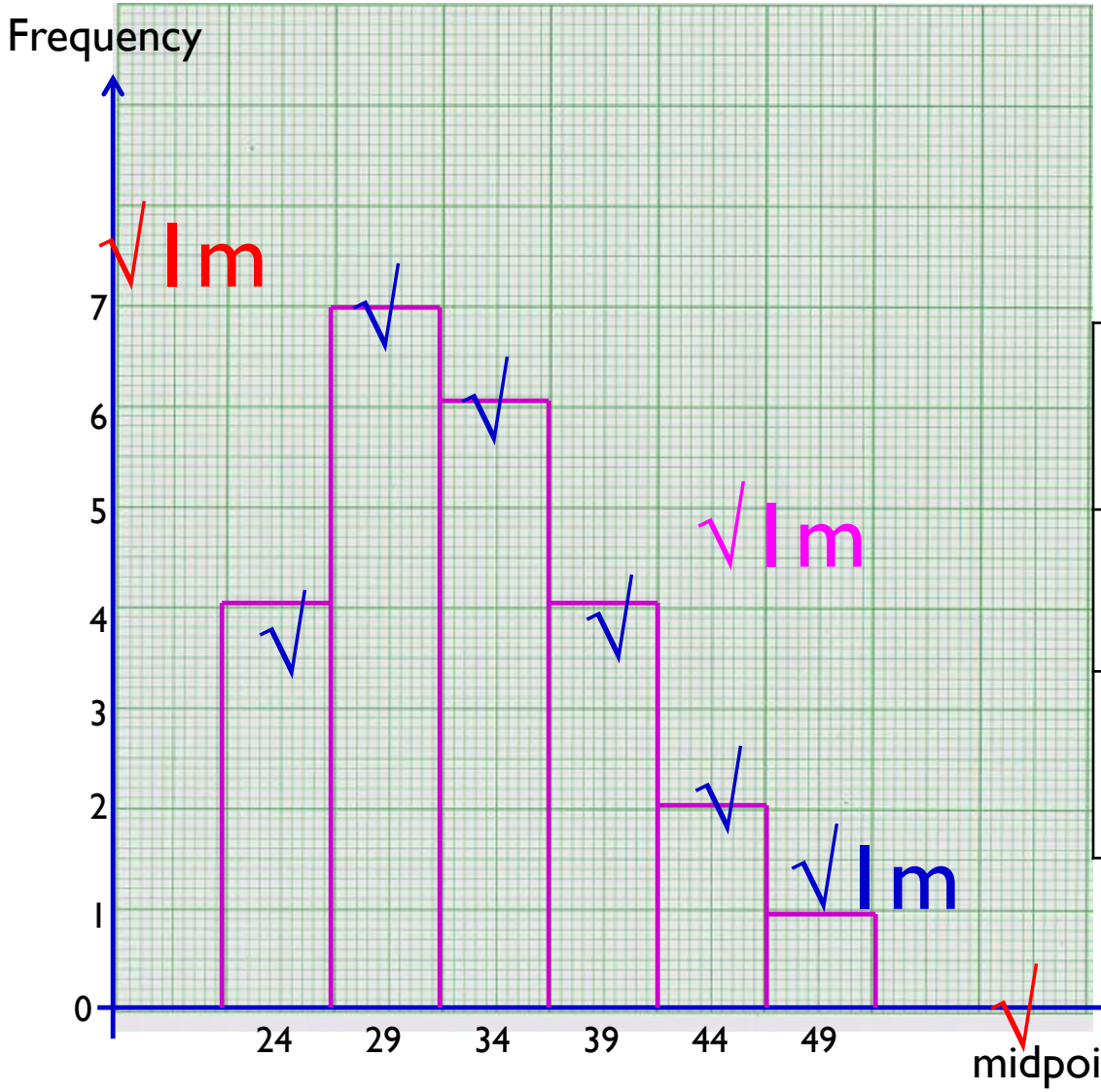
(c) Calculate the estimated mean for the number of books read by a student. [3 marks]

Answer :

$$= \frac{4\times 24 + 7\times 29 + 6\times 34 + 4\times 39 + 2\times 44 + 1\times 49}{24}$$ √2m

$$= 33.17$$ √1m

(d) By using a scale of 2 cm to 5 books on the horizontal axis and 2 cm to 1 student on the vertical axis, draw a histogram for the data. [4 marks]



Uniform scale within the range	**√1m**
All "Bar" drawn correctly	√1m
Scale and all points plotted correctly	√1m

(e) Based on the histogram drawn in 14(d), state the number of students who read less than 32 books in that programme. [1 mark]

Answer:

= 4 + 7

= 11 √1m

15. (a) Diagram 15.1 shows a solid right prism with rectangular base *ABKJ* on a horizontal plane. The surface *BCFGK* is the uniform cross section of the prism. Rectangle *CDEF* is a horizontal plane and rectangular *FEHG* is an inclined plane. Edges *BC* and *KG* are vertical.

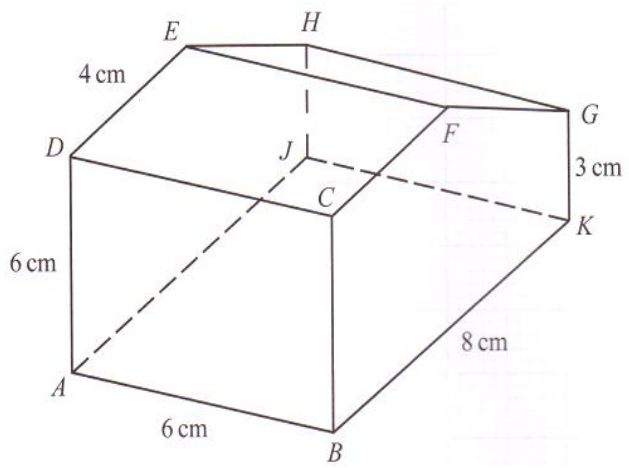
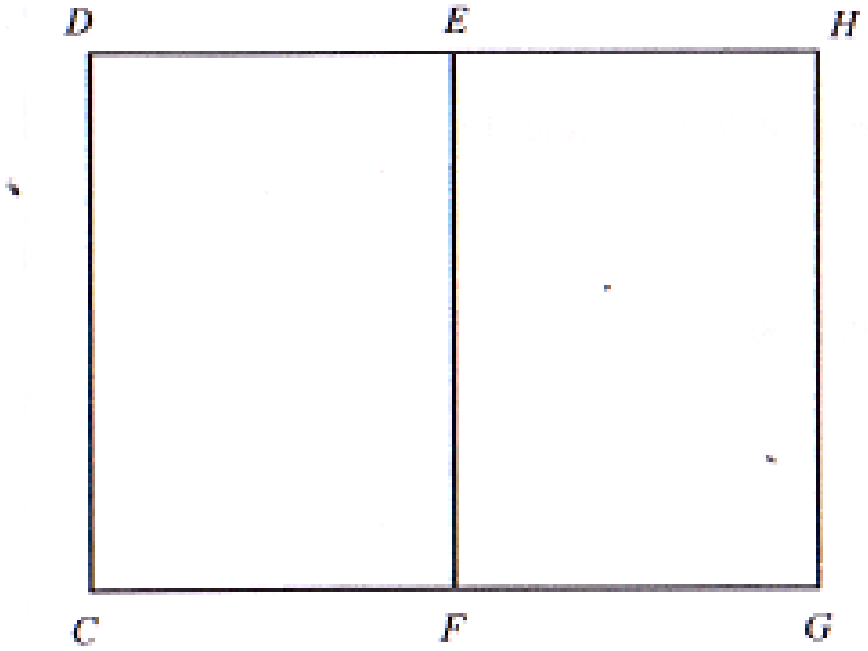


Diagram 15.1

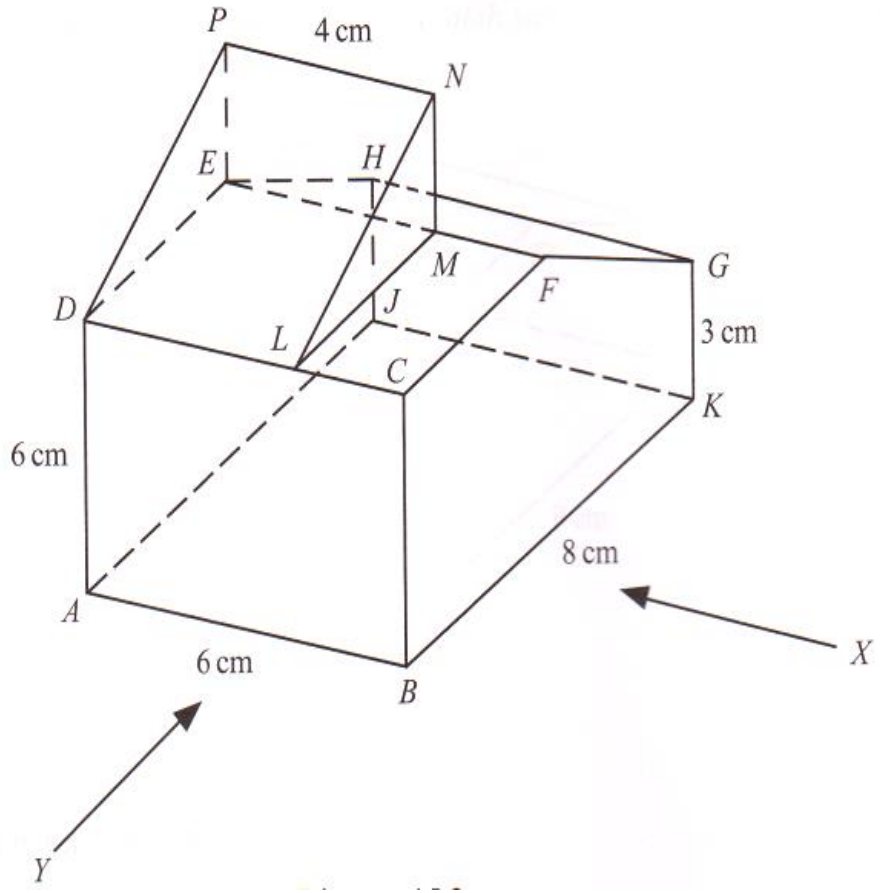
Draw to full scale, the plan of the solid.

Answer :



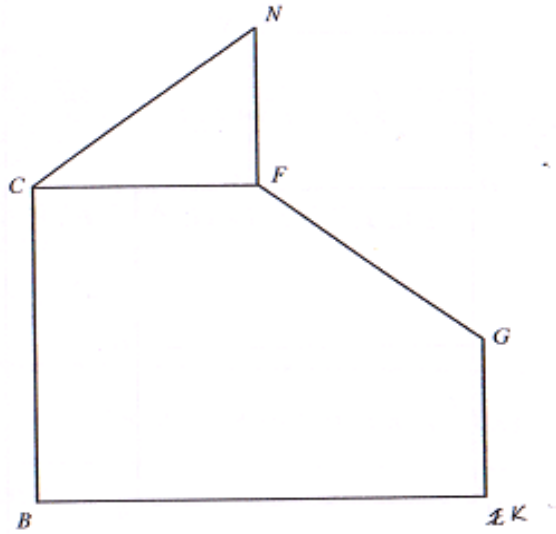
Solution/ mark scheme	Marks
Correct Shape	√1m
CG > GH > HE = ED	√1m (dep. √1m)
Measurements correct to +/- 0.2 cm Angles at edges of rectangles = 90°+/-1	√1m (dep. √1m √1m)

(b) Another solid right prism with right angled triangle *LMN* as its uniform cross section is joined to the prism in Diagram 15.1 at the horizontal plane *DLME*. It is given that *LM* = 4 cm and *MN* = 3 cm. The combined solid is as shown in Diagram 15.2.



(b) Draw to full scale,

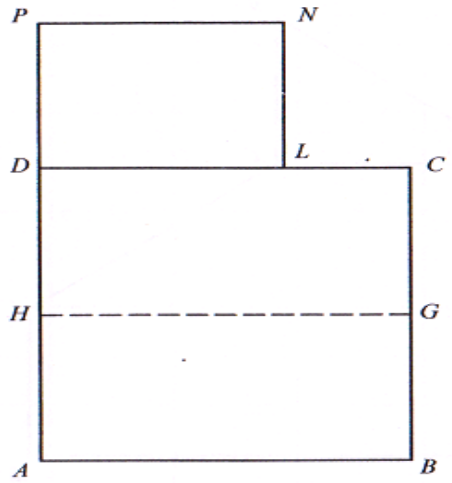
(i) the elevation of the combined solid on the vertical plane parallel to *BK* as viewed from *X*.



Solution/ mark scheme	Marks
Correct Shape	√1m
CG > GH > HE = ED	√1m (dep. √1m)
Measurements correct to +/- 0.2 cm Angles at edges of rectangles = 90°+/-1	√2m (dep. √1m √1m)

(ii) the elevation of the combined solid on the vertical plane parallel to *AB* as viewed from *Y*.

Answer:



Solution/ mark scheme	Marks
Correct Shape	√1m
H----G is joined by dashed line/ dotted line	√1m (dep. √1m)
AB=AD > DL > LN = CG = GB	√1m (dep. √1m √1m)
Measurements correct to +/- 0.2 cm Angles at edges of rectangles = 90°+/- 1	√2m (dep. √1m √1m √1m)

16. $G(40°S, 70°E)$, $H(40°S, 100°E)$, J and K are four points on the surface of the earth. JG is the diameter of the earth.

(a) State the location of point J.

$J(40°N, 110°W)$ √1m √1m√1m

(b) Calculate the shortest distance, in nautical miles, from G to the South pole measured along the surface of the earth.

Answer :

$= (90 - 40) \times 60$ √1m

$= 3000$ √1m

(c) K is 5700 nautical miles due north of H measured along the surface of the earth.

Calculate the latitude of K.

Answer :

$\frac{5700}{60} - 40$ √1m √1m

$55°N$ √1m

(d) An aeroplane took off from G and flew due east to H.

The average speed of the aeroplane for the whole flight was 400 knot.

Calculate the total time, in hours, taken for the whole flight.

Answer :

$$= \frac{(100 - 70) \times 60 \times \cos 40°}{400} \quad \sqrt{1m} \quad \sqrt{1m} \quad \sqrt{1m}$$

$$= 3.45 \quad \sqrt{1m}$$

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Thank You