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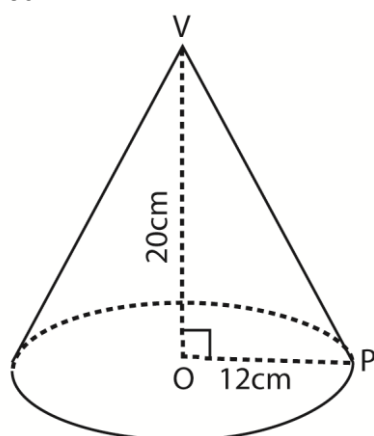


## UCE MATHEMATICS PAPER 2 2015 guide

### SECTION A (40 marks)

Answer all questions in this section

1. Simplify;  $\left(\frac{8}{27}\right)^{-\frac{2}{3}}$  (04marks)
2. Find equation of the line through the point  $r(5, 9)$  and parallel to the line joining points  $S(15, -2)$  to point  $T(-3, 4)$  (04marks)
3. Amina bought a television set (TV) at a discount of 5%. The market price of the TV was Shs. 320,000. How much did she buy the TV? (04 marks)
4. Given  $P(2, 3)$  and  $Q(5, 8)$  are two points in a plane, determine the
  - (b) Vector  $PQ$ . (02marks)
  - (c) Magnitude of  $PQ$ . (02marks)
5. Solve  $\log_{10}(7x + 2) - \log_{10}(x - 1) = 1$ . (04marks)
6. The function  $h(x) = bx^2 + 4x$ . if  $h(-1) = 3$ , find the value of  $b$ . (04marks)
7. In a class of 15 students, 7 like mathematic, 9 like English and 2 like neither Mathematics nor English. Find the number of student who like both Mathematics and English. (04 marks)
8. The capacity of a cylindrical tin is 2 litres. Its radius is 8cm. find its height. (04marks)
9. A line has a gradient  $\frac{1}{2}$  and passes through the point  $(-4, 7)$ . Find the coordinates of the point which the line cuts the  $y$ -axis. (04marks)
10. The figure below shows a cone whose base radius is 12cm. and perpendicular height  $OV$  is 20cm



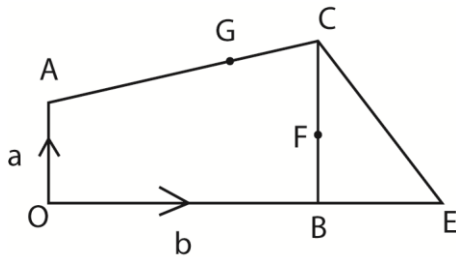
Determine the

- (i) Slant height  $PV$
- (ii) Area of curved surface of the cone

## SECTION B (60 MARKS)

Answer any **five** questions from this section. All questions carry equal marks.

11. (a) A map has a scale of 1:250,000 the area of the swamp on the map is  $12\text{cm}^2$ . What is the actual area of the swamp in  $\text{km}^2$ ? (05marks)
- (b) In a business John gets a fixed pay of shs. 80,000 and Daniel gets shs. 60,000 per month. The remainder is shared among John, Daniel and tom in the ratio 2:3:5 respectively. At the end of a certain month the business made shs. 480,000. Determine the amount of each got from the business.(07marks)
12. (a) A mapping defined by  $f(x) = x^2 - x + 3$ . Determine the range of the mapping whose domain is  $\{-3, 0, 1, 2\}$ . (05marks)
- (b) Given that  $h(x) = 3x - 5$  and  $g(x) = x^2$ , find  $hg(-2)$ . (03marks)
- (c) If  $f(x) = 2x + 5$ , find the value of  $f^{-1}(11)$  (04marks)
13. In the diagram below,  $OA = a$ ,  $OB = b$ ,  $BC = 2OA$  and  $3OB = 2OE$ . F is the mid-point of BC. G divides  $\overline{AC}$  in the ratio 2:1.

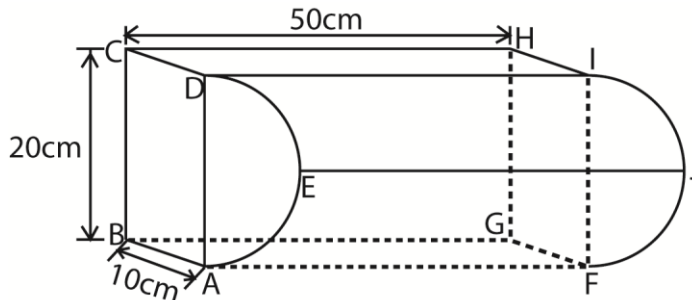


- (a) Express in terms of  $a$  and  $b$  the vectors
  - (i)  $\overrightarrow{CB}$
  - (ii)  $\overrightarrow{AC}$
  - (iii)  $\overrightarrow{BE}$  (06marks)
- (b) Show that G, F and E are collinear.
14. Two towns A and B are 200km apart. A Tata lorry left town A at noon and travelling at a speed of 50km/hr for one hour. It stopped for 30minutes the continued to B at a speed of 60km/hr. An Isuzu lorry left town B at 12.30p.m and travelled for 1hour at a speed of 40km/hr. It then changed and travelled at a speed of  $V$  km/hr and arrived at town A at 4:30p.m.
  - (a) Using scales 2cm to represent 20km and 4cm to represent one hour, draw distance time graphs showing the journeys for the two Lorries on the same axes. (07marks)
  - (b) Use the graphs to estimate
    - (i) Distance from A to the point where the two vehicles met.
    - (ii) Time at which the two vehicles met
    - (iii) Time of arrival of the Tata lorry at town M
    - (iv) The speed ( $V$ ) of the Isuzu lorry. (05 marks)
15. (a) A workers gross salary is sh. 200,000 per month. If sh.130, 000 is tax-free and the rest is taxed at 10%. What is the worker's net pay per month? (04marks)
- (b) Mr. odoi and Mrs Kaiso are money lenders. Mr. Odoi lends money at simple interest rate of 15% per annum. Mrs Kaiso lend money at compound interest rate of 15% per annum. A trader wants to borrow shs. 500,000 for 2 years. Which lender would be cheaper and by how much? (08marks)
16. A factory supplies food to 129 factory workers. It found out that 72 worker like matooke (M), 50 like potatoes (P) and 32 like rice (R). 15 like matooke and rice. 18 like matooke and

potatoes. 7 like potatoes and rice. 44 like matooke only. 10 dislike all the three types of food.

- Represent the given information on a Venn diagram. (06marks)
- Find the number of works who like all the three types of food.
- Find the probability that a worker chosen at random from the factory likes at most two types of food. (03 marks)

17. The diagram below shows a piece of wood of uniform cross section ABCDE in which ABCD is a rectangle and ADE is a semi-circle of diameter AD.  $\overline{AC} = 20\text{cm}$ ,  $\overline{AB} = 10\text{cm}$  and  $\overline{CH} = 50\text{cm}$ .



Calculate the:

- Area of the cross section ABCDE, (04marks)
- Volume of the wood (02marks)
- Total surface area of the piece of wood. (06marks)

## Solutions

### SECTION A (40 marks)

Answer all questions in this section

- Simplify;  $\left(\frac{8}{27}\right)^{-\frac{2}{3}}$  (04marks)  

$$\left(\frac{8}{27}\right)^{-\frac{2}{3}} = \left(\frac{27}{8}\right)^{\frac{2}{3}} = \left(\sqrt[3]{\frac{27}{8}}\right)^2 = \left(\frac{3}{2}\right)^2 = \frac{9}{4} = 2\frac{1}{4}$$
- Find equation of the line through the point R(5, 9) and parallel to the line joining points S(15, -2) to point T(-3, 4) (04marks)  
 Let (x, y) lie on the line

Gradient of RP = gradient of ST

$$\frac{y-9}{x-5} = \frac{4-(-2)}{-3-15}$$

$$\frac{y-9}{x-5} = \frac{6}{-18} = -\frac{1}{3}$$

$$y = -\frac{1}{3}(x - 5) + 9$$

$$y = -\frac{1}{3}x + \frac{32}{3}$$

$$3y + x - 32 = 0$$

- Amina bought a television set (TV) at a discount of 5%. The market price of the TV was Shs. 320,000. How much did she buy the TV? (04 marks)

$$\text{Discount} = \frac{5}{100} \times 320,000 = \text{sh. } 16,000$$

$$\text{Buying price} = 320,000 - 16,000 = \text{sh. } 304,000$$

Or

$$\begin{aligned}\text{Buying price} &= \left( \frac{100}{100} - \frac{5}{100} \right) 320,000 \\ &= \frac{95 \times 320,000}{100} = 304,000\end{aligned}$$

4. Given P(2, 3) and Q(5, 8) are two points in a plane, determine the  
(a) Vector PQ. (02marks)

$$\begin{aligned}\text{PQ} &= \text{OQ} - \text{OP} \\ &= \begin{pmatrix} 5 \\ 8 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \end{pmatrix} \\ &= \begin{pmatrix} 3 \\ 5 \end{pmatrix}\end{aligned}$$

- (b) Magnitude of PQ. (02marks)

$$\begin{aligned}\text{Magnitude of PQ} &= |\text{PQ}| \\ &= \sqrt{3^2 + 5^2} = \sqrt{9 + 25} = \sqrt{34} = 5.83095 = 5.8 \text{ unit (1D)}\end{aligned}$$

5. Solve  $\log_{10}(7x + 2) - \log_{10}(x - 1) = 1$ . (04marks)

$$\log_{10}(7x + 2) - \log_{10}(x - 1) = 1.$$

$$\log_{10} \frac{(7x+2)}{(x-1)} = 1.$$

$$\frac{(7x+2)}{(x-1)} = 10^1$$

$$7x + 2 = 10(x - 1)$$

$$7x + 2 = 10x - 10$$

$$3x = 12$$

$$x = 4$$

6. The function  $h(x) = bx^2 + 4x$ . if  $h(-1) = 3$ , find the value of b. (04marks)

$$h(-1) = 3$$

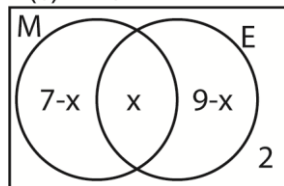
$$b(-1)^2 + 4(-1) = 3$$

$$b = 3 + 4 = 7$$

7. In a class of 15 students, 7 like mathematic, 9 like English and 2 like neither Mathematics nor English. Find the number of student who like both Mathematics and English. (04 marks)

$$\text{Let } n(M \cap E) = x$$

$$n(E) = 15$$



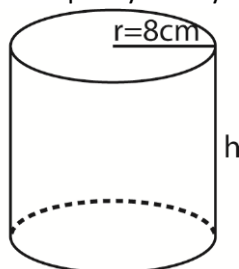
$$7 - x + x + 9 - x + 2 = 15$$

$$18 - x = 15$$

$$-x = -3$$

$$x = 3$$

8. The capacity of a cylindrical tin is 2 litres. Its radius is 8cm. find its height. (04marks)



$$2l = 2 \times 1000 = 2,000\text{cm}^3$$

$$\text{Volume} = \pi r^2 h$$

$$2,000 = 3.14 \times 8^2 h$$

$$h = \frac{2000}{3.14 \times 64} = \frac{2000}{20096} = 9.952\text{cm}$$

9. A line has a gradient  $\frac{1}{2}$  and passes through the point  $(-4, 7)$ . Find the coordinates of the point which the line cuts the y-axis. (04marks)

From the equation of the line,  $y = mx + c$ ; substituting for the point  $(-4, 7)$

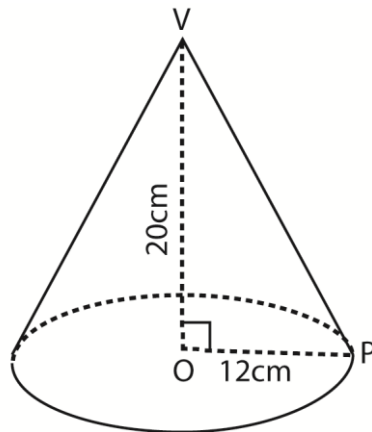
$$7 = \frac{1}{2}(-4) + c$$

$$7 = -2 + c$$

$$c = 9$$

Hence the line cuts the y-axis at  $(0, 9)$

10. The figure below shows a cone whose base radius is 12cm. and perpendicular height OV is 20cm



Determine the

- (i) Slant height PV

$$\overline{PV}^2 = 20^2 + 12^2 = 400 + 144 = 544$$

$$\overline{PV} = \sqrt{544} = 23.32\text{cm}$$

- (ii) Area of curved surface of the cone

$$\text{Area of the curved surface} = \pi r l = 3.14 \times 12 \times 23.32 = 878.7\text{cm}^2$$

#### SECTION B (60 MARKS)

Answer any **five** questions from this section. All questions carry equal marks.

11. (a) A map has a scale of 1:250,000 the area of the swamp on the map is  $12\text{cm}^2$ . What is the actual area of the swamp in  $\text{km}^2$ ? (05marks)

$$1\text{cm} = 250,000\text{ cm} = \frac{250,000}{100,000} = 2.5\text{km}$$

$$1\text{cm}^2 = (2.5\text{km})^2 = 6.25\text{km}^2$$

$$12\text{cm}^2 = 12 \times 6.25 = 75\text{km}^2$$

- (b) In a business John gets a fixed pay of shs. 80,000 and Daniel gets shs. 60,000 per month.

The remainder is shared among John, Daniel and tom in the ratio 2:3:5 respectively. At the end of a certain month the business made shs. 480,000. Determine the amount of each got from the business.(07marks)

$$\text{Total fixed pay} = \text{Joh's fixed Pay} + \text{Daniel's fixed pay} = 80,000 + 60,000$$

$$= \text{shs. } 140,000$$

$$\text{Remainder} = 480,000 - 140,000 = \text{shs. } 340,000$$

$$\text{Total ratio} = 2 + 3 + 5 = 10$$

$$\text{John gets} = 80,000 + \frac{2}{10} \times 340,000 = \text{shs. } 148,000$$

$$\text{Daniel gets} = 60,000 + \frac{3}{10} \times 340,000 = \text{shs. } 162,000$$

$$\text{Tom gets} = \frac{5}{10} \times 340,000 = \text{shs. } 170,000$$

12. (a) A mapping defined by  $f(x) = x^2 - x + 3$ . Determine the range of the mapping whose domain is  $\{-3, 0, 1, 2\}$ . (05marks)

$$f(-3) = (-3)^2 - 3 + 3 = 15$$

$$f(0) = 0^2 - 0 + 3 = 3$$

$$f(1) = 1^2 - 1 + 3 = 3$$

$$f(2) = 2^2 - 2 + 3 = 5$$

$$\text{Range} = \{3, 5, 15\}$$

- (d) Given that  $h(x) = 3x - 5$  and  $g(x) = x^2$ , find  $hg(-2)$ . (03marks)

$$g(-2) = (-2)^2 = 4$$

$$hg(-2) = h(4) = 3(4) - 5 = 12 - 5 = 7$$

- (e) If  $f(x) = 2x + 5$ , find the value of  $f^{-1}(11)$  (04marks)

$$\text{Let } y = f(x)$$

$$\Rightarrow y = 2x + 5$$

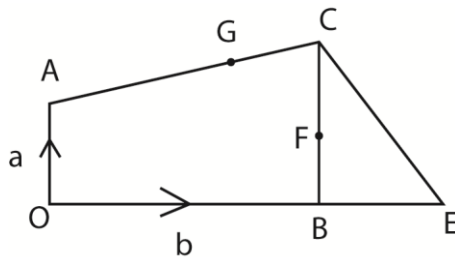
$$2x = y - 5$$

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

$$f^{-1}(x) = \frac{x-5}{2}$$

$$f^{-1}(11) = \frac{11-5}{2} = \frac{6}{2} = 3$$

13. In the diagram below,  $OA = a$ ,  $OB = b$ ,  $BC = 2OA$  and  $3OB = 2OE$ . F is the mid-point of BC. G divides  $\overline{AC}$  in the ratio 2:1.



- (a) Express in terms of  $a$  and  $b$  the vectors

- (i)  $\overrightarrow{CB}$

$$\overrightarrow{CB} = -\overrightarrow{BC} = -2a$$

- (ii)  $\overrightarrow{AC}$

$$\overrightarrow{AC} = \overrightarrow{AO} + \overrightarrow{OB} + \overrightarrow{BC}$$

$$-a + b + 2a = a + b$$

- (iii)  $\overrightarrow{BE}$  (06marks)

$$\overrightarrow{BE} = \overrightarrow{OE} - \overrightarrow{OB}$$

$$= \frac{3}{2}b - b = \frac{1}{2}b$$

- (b) Show that G, F and E are collinear.

$$\overrightarrow{GF} = \overrightarrow{GA} + \overrightarrow{AO} + \overrightarrow{OB} + \overrightarrow{BF}$$

$$= -\overrightarrow{GA} - \overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{BF}$$

$$= -\frac{2}{3}(a + b) - a + b + a$$

$$= -\frac{2}{3}(a + b) + b$$

$$= \frac{1}{3}(b - 2a)$$

$$GE = GA + AO + OE$$

$$= -GA - OA + OE$$

$$= -\frac{2}{3}(a + b) - a + \frac{3}{2}b$$

$$= \frac{-4(a+b)-6a+9b}{6} = \frac{5b-10a}{6} = \frac{5}{6}(b - 2a)$$

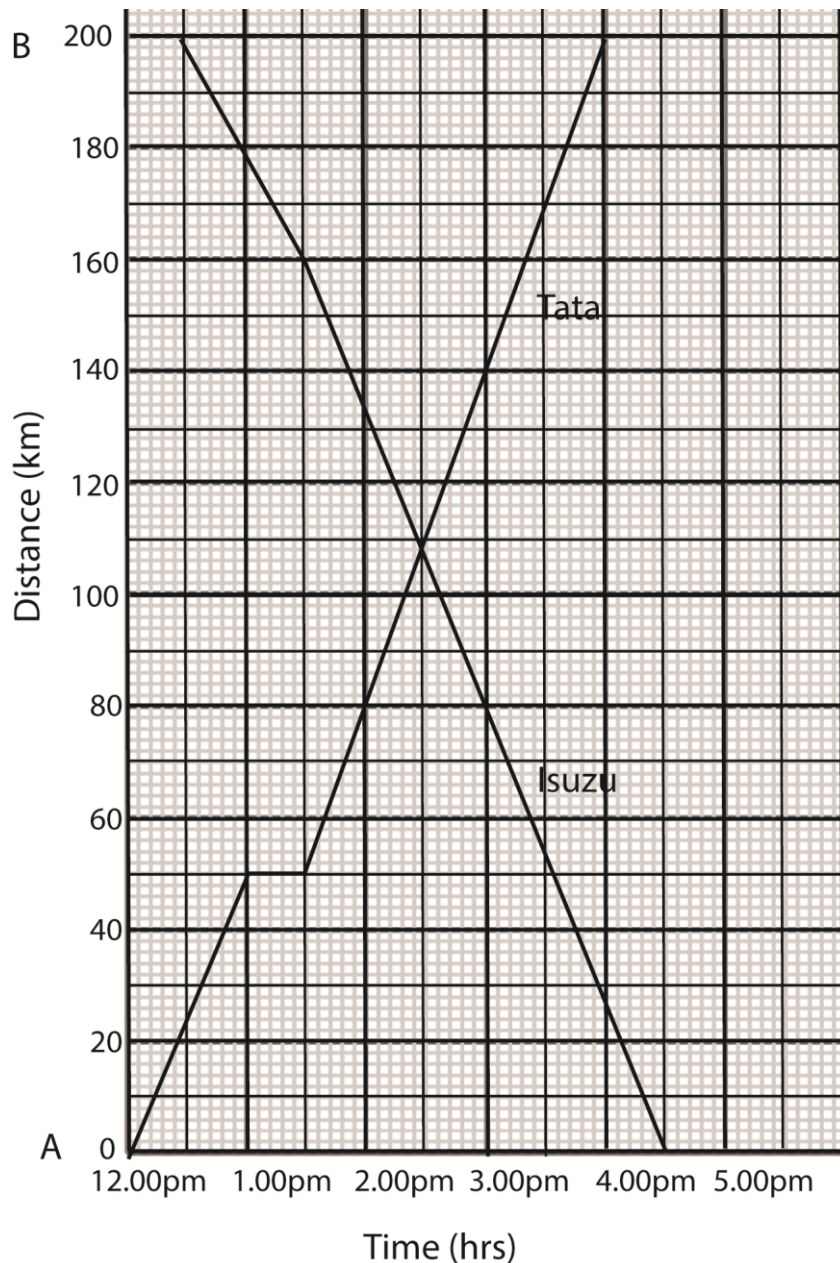
$$\text{Ratio of GE: GF} = \left[ \frac{1}{3}(b - 2a) \right] \div \left[ \frac{5}{6}(b - 2a) \right] = \frac{1}{3} \times \frac{6}{5} = \frac{2}{5}$$

$$\Rightarrow 2\overline{GE} = 5\overline{GF}$$

Since G is common on both sides, then, f and e are collinear.

14. Two towns A and B are 200km apart. A Tata lorry left town A at noon and travelling at a speed of 50km/hr for one hour. It stopped for 30minutes the continued to B at a speed of 60km/hr. An Isuzu lorry left town B at 12.30p.m and travelled for 1hour at a speed of 40km/hr. It then changed and travelled at a speed of V km/hr and arrived at town A at 4:30p.m.

(a) Using scales 2cm to represent 20km and 4cm to represent one hour, draw distance time graphs showing the journeys for the two Lorries on the same axes. (07marks)



(b) Use the graphs to estimate

- (i) Distance from A to the point where the two vehicles met = 108km
- (ii) Time at which the two vehicles met = 2.30pm
- (iii) Time of arrival of the Tata lorry at town M = 4.00pm
- (iv) The speed (V) of the Isuzu lorry. (05 marks)

$$\text{Average speed, } V = \frac{\text{Distance}}{\text{time}} = \frac{160}{3} = 53.3 \text{ km hr}^{-1}$$

15. (a) A worker's gross salary is sh. 200,000 per month. If sh.130,000 is tax-free and the rest is taxed at 10%. What is the worker's net pay per month? (04marks)

$$\begin{aligned} \text{Taxable income} &= \text{Gross pay} - \text{tax free income} \\ &= 200,000 - 130,000 = \text{shs. } 70,000 \end{aligned}$$

$$\text{Tax} = \frac{10}{100} \times 70,000 = \text{shs. } 7,000$$

$$\begin{aligned} \text{Net pay} &= \text{Gross pay} - \text{tax} \\ &= 200,000 - 7,000 = \text{shs. } 193,000 \end{aligned}$$



- (b) Mr. Odoi and Mrs. Kaiso are money lenders. Mr. Odoi lends money at simple interest rate of 15% per annum. Mrs. Kaiso lend money at compound interest rate of 15% per annum. A trader wants to borrow shs. 500,000 for 2 years. Which lender would be cheaper and by how much? (08marks)

For Odi

$$\text{Simple interest} = PRT = 500,000 \times \frac{15}{100} \times 2 = \text{shs. } 150,000$$

$$\text{Amount payable} = 500,000 + 150,000 = \text{shs. } 650,000$$

For Kaiso

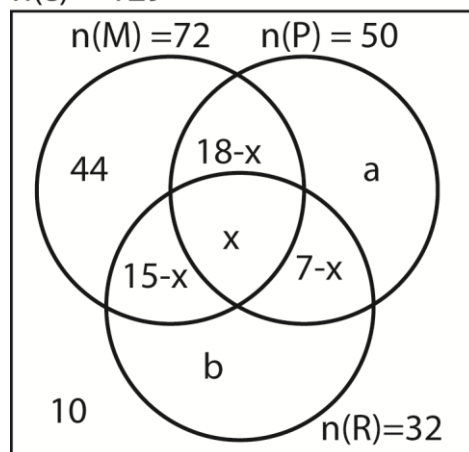
$$\begin{aligned} \text{Amount payable} &= P\left(1 + \frac{r}{100}\right)^n \\ &= 500,000 \left(1 + \frac{15}{100}\right)^2 = \text{shs. } 661,250 \end{aligned}$$

Mr. Odoi is cheaper by  $(661,250 - 650,000) = \text{shs. } 11,250$

16. A factory supplies food to 129 factory workers. It found out that 72 worker like matooke (M), 50 like potatoes (P) and 32 like rice (R). 15 like matooke and rice. 18 like matooke and potatoes. 7 like potatoes and rice. 44 like matooke only. 10 dislike all the three types of food.

- (a) Represent the given information on a Venn diagram. (06marks)

$$n(\epsilon) = 129$$



- (b) Find the number of works who like all the three types of food.

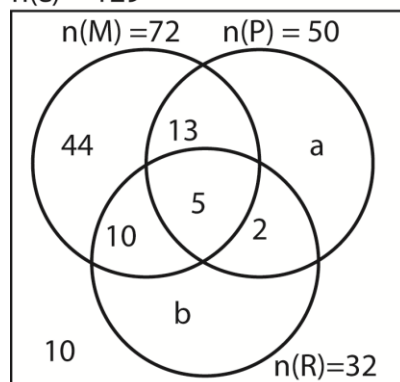
$$n(M) = 72$$

$$44 + 15 - x + x + 18 - x = 72$$

$$x = 5$$

- (c) Find the probability that a worker chosen at random from the factory likes at most two types of food. (03 marks)

$$n(\epsilon) = 129$$



$$n(P) = 50$$

$$13 + 5 + 2 + a = 50$$

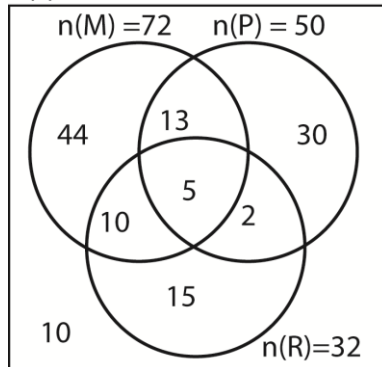
$$a = 30$$

$$n(R) = 32$$

$$10 + 5 + 2 + b = 32$$

$$b = 15$$

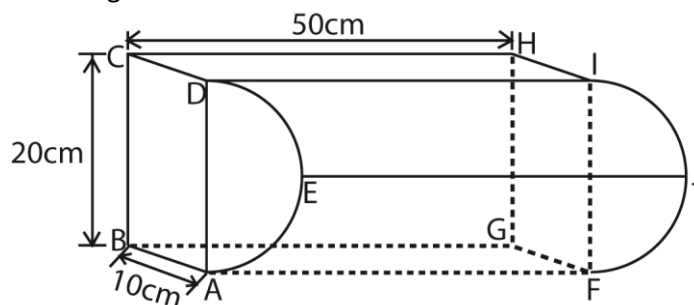
$$n(\epsilon) = 129$$



Number of worker who like at most 2 food =  $44 + 13 + 30 + 10 + 2 + 15 = 114$

$$P(\text{at most two food}) = \frac{114}{129} = 0.884$$

17. The diagram below shows a piece of wood of uniform cross section ABCDE in which ABCD is a rectangle and ADE is a semi-circle of diameter AD.  $\overline{AC} = 20\text{cm}$ ,  $\overline{AB} = 10\text{cm}$  and  $\overline{CH} = 50\text{cm}$ .



Calculate the:

- (a) Area of the cross section ABCDE, (04marks)

$$\begin{aligned} \text{Area} &= l \times b + \frac{1}{2} \pi r^2 \\ &= 10 \times 20 + \frac{1}{2} \times 3.14 \times 10^2 = 375\text{cm}^2 \end{aligned}$$

- (b) Volume of the wood (02marks)

$$\begin{aligned} \text{Volume} &= \text{Area of ABCDE} \times \text{length} \\ &= 375 \times 50 = 17850\text{cm}^3 \end{aligned}$$

- (c) Total surface area of the piece of wood. (06marks)

$$\begin{aligned} \text{Surface area} &= 2 \times \text{area of ABCDE} + \text{area of BCHG} + \text{area of ABGF} + \text{area of CDIH} + \text{area of DEAFJI} \\ &= 3 \times 375 + 20 \times 50 + 10 \times 50 + 50 \times 10 + \frac{1}{2} \times 3.14 \times 20 \times 50 \\ &= 714 + 1000 + 500 + 500 + 1570 \\ &= 4,284\text{cm}^2 \end{aligned}$$

Thank you

Dr. Bbosa Science

