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UCE MATHEMATICS PAPER 2 2013 guide

SECTION A (40 marks)

Answer all questions in this section

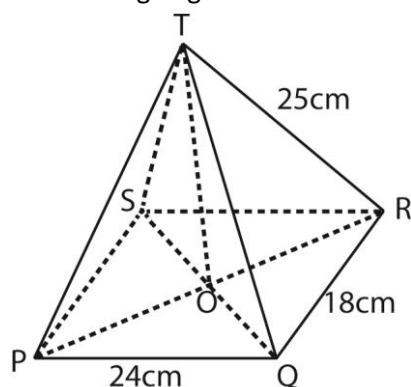
- Without using mathematical tables or a calculator, simplify $\frac{(0.25)^2 \times \left(\frac{1}{64}\right)^2}{(128)^{-2}}$. (04 marks)
- Given that $M = \{\text{the five multiples of 3}\}$ and $S = \{\text{the first five square numbers}\}$, find
 - $M \cap S$
 - $nM \cap S$
- The position vector of P and Q are $\begin{pmatrix} -6 \\ 15 \end{pmatrix}$ and $\begin{pmatrix} 4 \\ 5 \end{pmatrix}$ respectively.
Find the magnitude of PQ. (04marks)
- A line whose gradient is 3, passes through the point (2, 1). Find the
 - equation of the line
 - y-intercept (04marks)
- Simplify $\frac{2.4 \times 10^2}{6.0 \times 10^{-3}}$
- Given the $f(x) = 3x + 5$ and $g(x) = \frac{2}{x-5}$, find
 - $gf(x)$
 - $gf\left(\frac{1}{2}\right)$ (04marks)
- Find the distance between the points (5, 9) and (-7, 2). Give your answer to one decimal place (04marks)
- A traveller had £800. She exchanged into Uganda shillings (Ug. Shs.) at a rate of £1 for Ug. Shs. 3,200. She used Ug. Shs. 720, 000 in a hotel. How much money in Ug. Shs. Did she remain with? (04marks)
- Two similar plastic containers have capacities of 2 litres and 54 litres. If the height of the big container is 87 cm, find the height of the small container. (04 marks)
- A scale on a map is 1; 500,000. What distance in kilometres does 2 centimetre on the map represent?

SECTION B (60MARKS)

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

- If $h(x) = px + 3$ and that $h(4) = 23$.
 - Find the value of
 - p
 - $h(0)$
 - $h(-5)$ (07marks)

- (b) determine
- $h^{-1}(x)$
 - $h^{-1}(13)$ (05 marks)
12. A quantity p is partly constant and partly varies as the square of q . when $q = 2$, $p = 40$; when $q = 3$, $p = 65$.
- Form an equation relating p and q . (08 marks)
 - Determine the values of q when $p = 100$. (04 marks)
13. (a) Peter deposited shs. 2,500,000 in a bank which offers a compound interest of 15% per annum. How much money did he have in the bank at the end of two years? (05 marks)
- (b) The cash price of a radio is shs. 720,000. It can be bought on a hire purchase terms by marking a deposit of 30% of the cash price and then paying 8 monthly instalments of shs. 85, 000 each.
- Find the cost of the radio on hire purchase term
 - How much more does one pay on hire purchase rather than on cash term? (07 marks)
14. In a class of 40 students, 18 play Hockey (H), 15 play Tennis (T) and 22 play Football. 7 play hockey and tennis. 9 play tennis and football. 8 play hockey and football. 4 play all the three games.
- Represent the given information on a Venn diagram. (06marks)
 - Find the number of students who do not play any of the three games. (02 marks)
 - Find the probability that a student chosen at random plays only
 - one game
 - two games (04marks)
15. A cyclist sets off from town A at 4.00am at a speed of 20kmh^{-1} to go to town B, 100km away. A motorist also sets off from town a at 7;30am at a speed of 100kmh^{-1} to go to town B. Find
- distance from town A when the motorist overtakes the cyclist. (06 marks)
 - time when the motorist overtakes the cyclist (03marks)
 - time the cyclist reached town B (03marks)
16. A quadrilateral OABC has points P, Q and R on OA, OB and OC respectively. $OA = 3OP$, $OB = 5OQ$ and $OC = 2OR$, $OP = p$, $OQ = q$ and $OR = r$.
- Express the following vectors in terms of p , q , and r .
 - PQ
 - AB
 - BC
 - CA (09marks)
 - Given that OABC is a parallelogram, show that $3p - 5q + 2r = 0$ (03 marks)
17. In the figure below, PQRST is a right pyramid with a rectangular base. $PQ = 24\text{cm}$, $QR = 18\text{cm}$. the slanting edges are 25cm each.



Calculate the:

- Height of the pyramid, (06marks)
- Angle between the slanting face QRT and the base (03 marks)
- Volume of the pyramid. (03marks)

Solutions

SECTION A (40 marks)

Answer all questions in this section

- Without using mathematical tables or a calculator, simplify $\frac{(0.25)^2 \times \left(\frac{1}{64}\right)^2}{(128)^{-2}}$. (04 marks)

$$\begin{aligned}\frac{(0.25)^2 \times \left(\frac{1}{64}\right)^2}{(128)^{-2}} &= (0.25)^2 \times \left(\frac{1}{64}\right)^2 \times (128)^2 \\ &= \left(\frac{25}{100}\right)^2 \times \left(\frac{1}{64}\right)^2 \times (2^7)^2 \\ &= \left(\frac{1}{4}\right)^2 \times \left(\frac{1}{64}\right)^2 \times (2^7)^2 \\ &= \left(\frac{1}{2^2}\right)^2 \times \left(\frac{1}{2^6}\right)^2 \times (2^7)^2 \\ &= 2^{-4} \times 2^{-12} \times 2^{14} \\ &= 2^{-2} = \frac{1}{2^2} = \frac{1}{4}\end{aligned}$$

- Given that $M = \{\text{the five multiples of 3}\}$ and $S = \{\text{the first five square numbers}\}$, find

No.	Multiple of 3 (M)	square No. (S)
1	$1 \times 3 = 3$	$1^2 = 1$
2	$2 \times 3 = 6$	$2^2 = 4$
3	$3 \times 3 = 9$	$3^2 = 9$
4	$4 \times 3 = 12$	$4^2 = 16$
5	$5 \times 3 = 15$	$5^2 = 25$

$$M = \{3, 6, 9, 12, 15\}$$

$$S = \{1, 4, 9, 16, 25\}$$

$$(a) M \cap S = \{9\}$$

$$(b) n(M \cap S) = 1$$

- The position vector of P and Q are $\begin{pmatrix} -6 \\ 15 \end{pmatrix}$ and $\begin{pmatrix} 4 \\ 5 \end{pmatrix}$ respectively.

Find the magnitude of PQ. (04marks)

$$PQ = OQ - OP$$

$$= \begin{pmatrix} 4 \\ 5 \end{pmatrix} - \begin{pmatrix} -6 \\ 15 \end{pmatrix} = \begin{pmatrix} 10 \\ -10 \end{pmatrix}$$

$$|PQ| = \sqrt{10^2 + (-10)^2} = \sqrt{100 + 100} = \sqrt{200} = 14.142 = 14.14 \text{ (2D)}$$

- A line whose gradient is 3, passes through the point (2, 1). Find the

(a) equation of the line

Let a point with coordinates (x, y) line on the line



$$(2,1) \qquad (x, y)$$

$$\text{Gradient} = \frac{y-1}{x-2} = 3$$

$$y - 1 = 3(x - 2)$$

$$y - 1 = 3x - 6$$

$$y = 3x - 5$$

(b) y-intercept (04marks)

the line cuts y-axis when $x =$

$$y = 0 - 5 = -5$$

hence y- intercept = (0, -5)

5. Simplify $\frac{2.4 \times 10^2}{6.0 \times 10^{-3}}$

$$\frac{2.4 \times 10^2}{6.0 \times 10^{-3}} = \frac{24}{10} \times 10^2 \times \frac{1}{6} \times 10^3 = 4 \times 10^4$$

6. Given the $f(x) = 3x + 5$ and $g(x) = \frac{2}{x-5}$; find

(a) $gf(x)$

$$gf(x) = g(3x + 5) = \frac{2}{(3x + 5) - 5} = \frac{2}{3x}$$

$$\therefore gf(x) = \frac{2}{3x}$$

(b) $gf(\frac{1}{2})$ (04marks)

$$gf(\frac{1}{2}) = \frac{2}{3\frac{1}{2}} = \frac{4}{3} = 1\frac{1}{3}$$

7. Find the distance between the points (5, 9) and (-7, 2). Give your answer to one decimal place (04marks)

Let points be P(5, 9) and Q(-7, 2).

$$\text{Distance between two points} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$PQ = \sqrt{(-7 - 5)^2 + (2 - 9)^2}$$

$$= \sqrt{(-12)^2 + (-7)^2}$$

$$= \sqrt{144 + 81}$$

$$= \sqrt{193} = 13.9 \text{ (1D)}$$

8. A traveller had £800. She exchanged into Uganda shillings (Ug. Shs.) at a rate of £1 for Ug. Shs. 3,200. She used Ug. Shs. 720, 000 in a hotel. How much money in Ug. Shs. Did she remain with? (04marks)

9. Two similar plastic containers have capacities of 2 litres and 54 litres. If the height of the big container is 87 cm, find the height of the small container. (04 marks)

$$V.S.F = \frac{\text{volume of big container}}{\text{volume of small container}} = \frac{54}{2} = 27$$

$$L.S.F = \sqrt[3]{27} = 3$$

$$\text{But } L.S.F = \frac{\text{height of big container}}{\text{height of small container}} = \frac{87}{h} = 3$$

$$h = \frac{87}{3} = 29\text{cm}$$

hence height of the small container is 29cm

10. A scale on a map is 1: 500,000. What distance in kilometres does 1 centimetre on the map represent?

$$1\text{cm} = 500,000\text{cm}$$

$$1\text{cm} = \frac{500,000}{100,000} = 5\text{km}$$

SECTION B (60MARKS)

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

11. If $h(x) = px + 3$ and that $h(4) = 23$.

(a) Find the value of

(i) p

$$h(4) = 4p + 3 = 23$$

$$4p = 20$$

$$p = 5$$

$$(ii) \quad h(0)$$

$$5(0) + 3 = 3$$

$$(iii) \quad h(-5) \text{ (07marks)}$$

$$h(-5) = 5(-5) + 3$$

$$= -25 + 3 = -22$$

(b) determine

$$(i) \quad h^{-1}(x)$$

$$\text{let } y = 5x + 3$$

$$5x = y - 3$$

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

$$h^{-1}(x) = \frac{x-3}{5}$$

$$(ii) \quad h^{-1}(13) \text{ (05 marks)}$$

$$h^{-1}(13) = \frac{13-3}{5} = 2$$

12. A quantity p is partly constant and partly varies as the square of q . when $q = 2$, $p = 40$; when $q = 3$, $p = 65$.

(a) Form an equation relating p and q . (08 marks)

$$p = a + kq^2$$

Substituting $q = 2$ and $p = 40$

$$a + k(2)^2 = 40$$

$$a + 4k = 40 \dots\dots\dots (i)$$

Substituting $q = 3$ and $p = 65$

$$a + k(3)^2 = 65$$

$$a + 9k = 65 \dots\dots\dots (ii)$$

Subtracting (i) from (ii)

$$5k = 25$$

$$k = 5$$

Substituting for $k = 5$ in eqn. (i)

$$a + 4(5) = 40$$

$$a = 20$$

Hence the equation

$$p = 20 + 5q^2$$

(b) Determine the values of q when $p = 100$. (04 marks)

$$100 = 20 + 5q^2$$

$$5q^2 = 80$$

$$q = \sqrt{16} = \pm 4$$

Hence $q = 4$ and $q = -4$

13. (a) Peter deposited shs. 2,500,000 in a bank which offers a compound interest of 15% per annum. How much money did he have in the bank at the end of two years? (05 marks)

With compound interest

$$A = p \left(1 + \frac{r}{100} \right)^n$$

$$= 2,500,000 \left(1 + \frac{15}{100} \right)^2$$

$$= \text{shs. } 3,306,250$$

- (b) The cash price of a radio is shs. 720,000. It can be bought on a hire purchase terms by marking a deposit of 30% of the cash price and then paying 8 monthly instalments of shs. 85, 000 each.

(i) Find the cost of the radio on hire purchase term

$$\begin{aligned}\text{Cost} &= \frac{30}{100} \times 720,000 + 8 \times 85,000 \\ &= 216,000 + 680,000 \\ &= \text{shs. } 896,000\end{aligned}$$

(ii) How much more does one pay on hire purchase rather than on cash term? (07 marks)

$$\text{Extra money paid} = 896,000 - 720,000 = \text{shs. } 176,000$$

14. In a class of 40 students, 18 play Hockey (H), 15 play Tennis (T) and 22 play Football. 7 play hockey and tennis. 9 play tennis and football. 8 play hockey and football. 4 play all the three games.

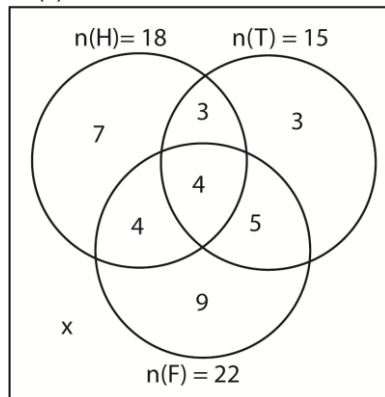
(a) Represent the given information on a Venn diagram. (06marks)

Summary

$$n(E) = 40, n(H) = 18, n(T) = 15, n(F) = 22, n(H \cap T) = 7, n(T \cap F) = 9, n(H \cap F) = 8,$$

$$n(H \cap T \cap F) = 4$$

$$n(E) = 40$$



$$T \text{ only} = 15 - (3 + 5 + 4) = 3$$

$$H \text{ only} = 18 - (3 + 4 + 4) = 7$$

$$P \text{ only} = 22 - (4 + 4 + 5) = 9$$

- (b) Find the number of students who do not play any of the three games. (02 marks)

$$18 + 3 + 5 + 9 + x = 40$$

$$35 + x = 40$$

$$x = 5$$

hence the number of students that do not play any of the three is 5

- (c) Find the probability that a student chosen at random plays only

(i) one game

$$\begin{aligned}\text{Students that play one game} &= n(H) \text{ only} + n(T) \text{ only} + n(F) \text{ only} \\ &= 7 + 3 + 9 = 19\end{aligned}$$

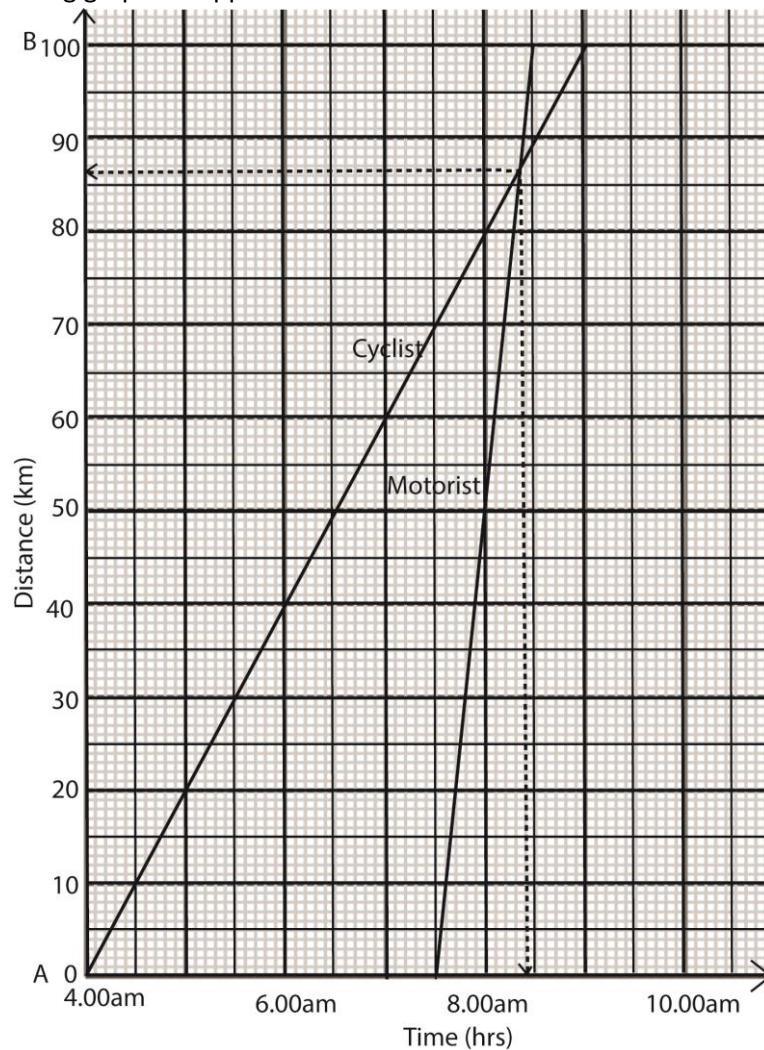
$$\text{Probability for the student chosen} = \frac{19}{40}$$

(iii) two games (04marks)

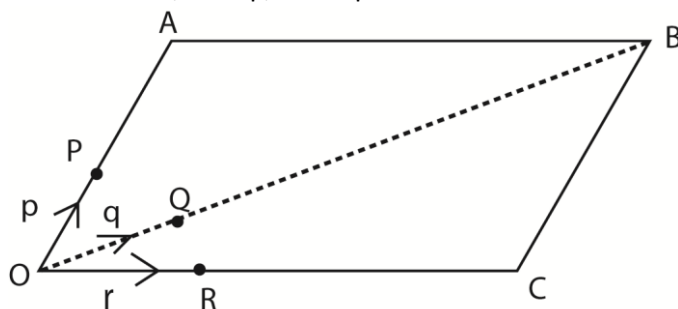
$$\begin{aligned}\text{Students that play two games} &= n(H \cap T), n(T \cap F) = 9, n(H \cap F) = 8 \\ &= 3 + 4 + 5 = 12\end{aligned}$$

$$\text{Probability that a student plays two games} = \frac{12}{40} = \frac{3}{10} = 0.3$$

15. A cyclist sets off from town A at 4.00am at a speed of 20kmh^{-1} to go to town B, 100km away. A motorist also sets off from town A at 7.30am at a speed of 100kmh^{-1} to go to town B. Find Using graphical approach.



- (a) distance from town A when the motorist overtakes the cyclist. (06 marks)
88km
- (b) time when the motorist overtakes the cyclist (03marks)
 $8:30 + \frac{4}{5} \times 30$ 8:54am
- (c) time the cyclist reached town B (03marks)
9:00am
16. A quadrilateral OABC has points P, Q and R on OA, OB and OC respectively. $OA = 3OP$, $OB = 5OQ$ and $OC = 2OR$, $OP = p$, $OQ = q$ and $OR = r$.



- (a) Express the following vectors in terms of p , q , and r .

- (i) $PQ = PO + OQ = -p + q$
(ii) $AB = AO + OB = -3OP + 5OQ = -3p + 5q$
(iii) $BC = BO + OC$
 $= -(-3p + 5q) + 2OR$
 $= 3p - 5q + 2r$
(iv) CA (09marks)
 $CA = CO + OA$
 $= -2r + 3p$

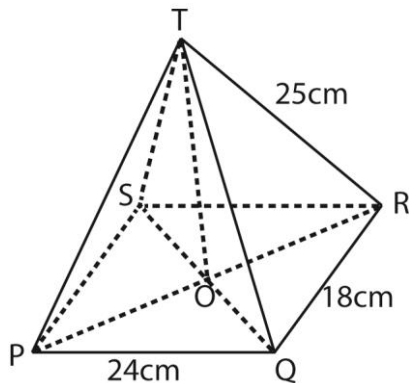
(b) Given that OABC is a parallelogram, show that $3p - 5q + 2r = 0$ (03 marks)

$$OB = OA + AB$$

$$5q = 3p + 2r$$

$$\Rightarrow 3p + 2r - 5q = 0$$

17. In the figure below, PQRT is a right pyramid with a rectangular base. PQ = 24cm, QR = 18cm. the slanting edges are 25cm each.



Calculate the:

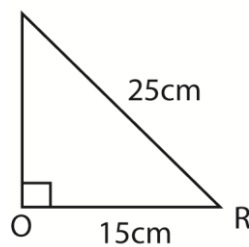
- (a) Height of the pyramid, (06marks)

$$PR^2 = 24^2 + 18^2 = 576 + 324 = 900$$

$$PR = \sqrt{900} = 30\text{cm}$$

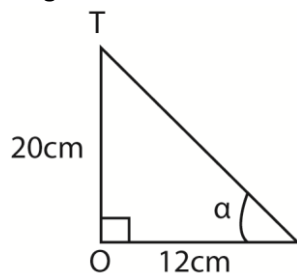
$$OR = 15\text{cm}$$

T



$$\text{Height } OT = \sqrt{25^2 - 15^2} = \sqrt{625 - 225} = \sqrt{400} = 20\text{cm}$$

- (b) Angle between the slanting face QRT and the base (03 marks)



$$\tan \alpha = \frac{20}{12}$$

$$\alpha = \tan^{-1} \left(\frac{20}{12} \right) = 59^\circ$$

(c) Volume of the pyramid. (03marks)

$$\text{Volume} = \frac{1}{3} Lwh = \frac{1}{3} \times 24 \times 18 \times 20 = 2,880 \text{ cm}^3$$

Thank you

Dr. Bbosa Science