SECTION A (50MARKS):ANSWER ALL QUESTIONS IN THIS SECTION

1. Evaluate using logarithms (4marks)

$\sqrt{\dfrac{4.283 \times (0.009478)^2}{\text{Log } 9.814}}$

No.	Std form	Logarithm:
4.283	4.283×10^{0}	0.6317
0.009478	9.478×10^{-3}	$\bar{3}.9767 \times 2$ +
$(0.009478)^2$ →		$\bar{5}.9534$ ←
		$\bar{4}.5851$
Log 9.814 (0.9918)	9.918×10^{-1}	$\bar{1}.9964$ ← −
		$\bar{4}.5887 \times \frac{1}{2}$
Anti Log		
$10^{\bar{2}.2944}$ ←		$\bar{2}.2944$

$\frac{1}{100} \times 1.9691$

$\bar{3}.9767 \times 2 = \bar{5}.9534$

$\bar{5} + (+1)$

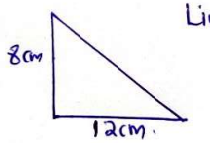
$\frac{\bar{4} + 0.5887}{2}$

$= \bar{2} + 0.2944$

≈ 0.0197 ✓✓

2. In this question mathematical tables or calculator should not used. The base and perpendicular height of a triangle measured to the nearest centimetres are 12cm and 8cm respectively; Find ;

(a) the absolute error in calculating the area of the triangle (2marks)



Limits $L = 8 \pm 0.5$

max = 8.5cm

min = 7.5cm

$B = 12 \pm 0.5$

max = 12.5cm

min = 11.5cm

Error = $\frac{1}{2}$ = 0.5

Max Area = $\frac{1}{2} \times 12.5\text{cm} \times 8.5\text{cm} = 53.125\text{cm}^2$

Min Area = $\frac{1}{2} \times 11.5 \times 7.5\text{cm} = 43.125\text{cm}^2$

Absolute Error = $\frac{53.125 - 43.125}{2}$

≈ 5 ✓✓

b) the percentage error in the area, giving the answer to 1 decimal place (2marks)

% Error = Relative Error × 100%

R.E = $\frac{\text{Absolute}}{\text{Actual}}$

Actual = $\frac{1}{2} \times 12 \times 8 = 48\text{cm}^2$

$\therefore$ R.E = $\frac{5}{48}$

% Error = $\frac{5}{48} \times 100$

≈ 10.42

$= 10.4\%$ ✓✓

3. Make L the subject in : (3marks)

$$H = \sqrt[3]{\left[\frac{3d(L-d)}{10L}\right]}$$

$(H^3)^3 = \left(\sqrt[3]{\frac{3d(L-d)}{10L}}\right)^3$

$H^3 = \frac{3d(L-d)}{10L}$

$10H^3L = 3dL - 3d^2$

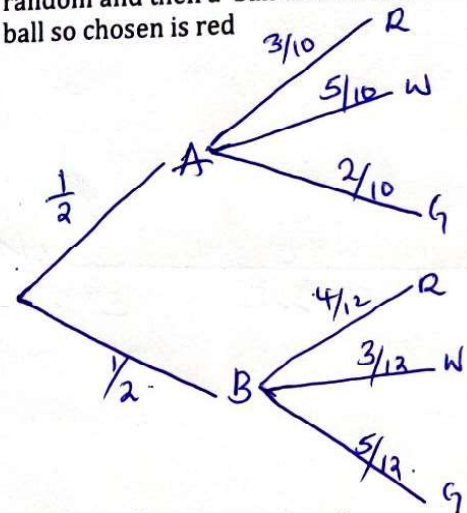
$10H^3L - 3dL = -3d^2$

$L(10H^3 - 3d) = -3d^2$

$\frac{L(10H^3 - 3d)}{10H^3 - 3d} = \frac{-3d^2}{10H^3 - 3d}$

$L = \frac{-3d^2}{10H^3 - 3d}$ ✓✓

4. A bag contains 10balls of which 3 are red, 5 are white and 2 are green. Another bag contains 12balls of which 4 are red, 3 are white and 5 are green. A bag is chosen at random and then a ball chosen at random from the bag. Find the probability that the ball so chosen is red (3marks)



$P(\text{A Red or B Red}) = \left(\frac{1}{2} \times \frac{3}{10}\right) + \left(\frac{1}{2} \times \frac{4}{12}\right)$

$= \frac{3}{20} + \frac{2}{12}$

$= \frac{19}{60}$ ✓✓

5. The sum of interior angles of two regular polygons of sides n and n + 2 are in the ratio 3:4. Calculate the sum of the interior angles of the polygon with n sides (3marks)

Sum given by: $(2n-4)90$;

$\therefore (2n-4)90 : (2(n+2)-4)90 = 3:4$.

$180n - 360 : 180n = 3:4$.

$\frac{180n-360}{180n} \times \frac{3}{4}$.

$720n - 1440^\circ = 540n$.

$\frac{180n}{180} = \frac{1440^\circ}{180}$ $n = 8$ sides.

$\text{Sum} = (2(8)-4)90^\circ$

$= 12 \times 90^\circ$

$= 1080^\circ$ ✓

6. Five year ago, a mother's age was four times that of her daughter. In four years to come, she will be 2 ½ times the age of her daughter. Calculate the sum of their present ages. (3mark)

Let: present ages: Mother x, Daughter y:

$\therefore x - 5 = 4(y-5)$

$x - 4y = -15$ ----(i).

Also; $x + 4 = 2.5(y+4)$

$x - 2.5y = 6$ ---(ii).

Solving simultaneously:

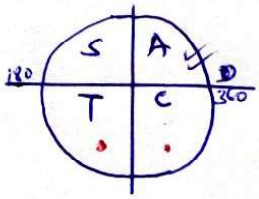
$x = 41$ yrs

$y = 14$ yrs;

$\text{Sum} = 41 + 14$

$= 55$ yrs ✓

7. Solve for x if $-\frac{1}{4}\sin(2x + 30) = 0.1607$, $0 \leq x \geq 360^0$ (3mks)



$\frac{-0.25\sin(2x+30)}{-0.25} = \frac{0.1607}{-0.25}$

$\sin(2x+30^\circ) = -0.6428$.

$\sin(2x+30^\circ) = 220^\circ, 320^\circ, 580^\circ, 680^\circ$

$\therefore 2x + 30^\circ = 220^\circ$

$\frac{2x}{2} = \frac{190^\circ}{2}$

$x = 95^\circ$.

$2x + 30^\circ = 320^\circ$

$\frac{2x}{2} = \frac{290}{2}$

$x = 145^\circ$.

$2x + 30^\circ = 580^\circ$

$\frac{2x}{2} = \frac{550}{2}$

$x = 275^\circ$

$2x + 30^\circ = 680^\circ$

$\frac{2x}{2} = \frac{650}{2}$ $x = 325^\circ$.

$x = 95^\circ, 145^\circ, 275^\circ, 325^\circ$

8. Given that $\sqrt{3} = 1.7321$, express in surd form, rationalize the denominator and then find the value of the expression below to 5 significant figures without using the calculator.(3mks)

$$\frac{2-\tan 60^0}{3-2\cos 30^0} \approx \frac{2-\sqrt{3}}{3-2\left(\frac{\sqrt{3}}{2}\right)}$$

$$= \frac{2-\sqrt{3}}{3-\sqrt{3}} \times \frac{3+\sqrt{3}}{3+\sqrt{3}}$$

$$\approx \frac{6+2\sqrt{3}-3\sqrt{3}-3}{9-3}$$

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

But $\sqrt{3} = 1.7321$

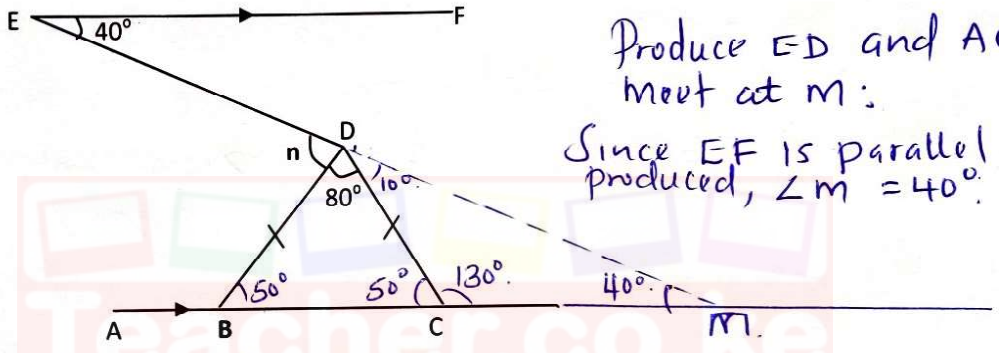
$$\frac{3-1.7321}{6}$$

$$= \frac{1.2679}{6}$$

$$\approx 0.211324$$

(3marks)

9. Giving reason, find the angle marked **n**



Produce ED and AC to meet at M:

Since EF is parallel to AC produced, $\angle M = 40^0$.

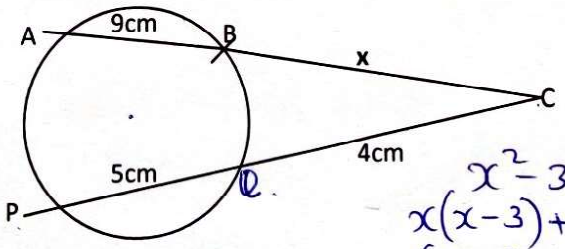
$180^0 - 50^0 = 130^0$

$180^0 - (130^0 + 40^0) = 10^0$

$\angle n = 180^0 - (80^0 + 10^0)$

$= 90^0$ (Angles on a straight line Add upto 180^0)

10. The figure below shows a circle centre O. AB and PQ are chords intersecting externally at a point C. AB = 9cm, PQ = 5cm and QC = 4cm. Find the value of **x** (2marks)



$QC \times CP = CA \times BC$.

$\therefore 4 \times 9 = (x+9)x$

$36 = x^2 + 9x$

$x^2 + 9x - 36 = 0$

$x^2 - 3x + 12x - 36 = 0$

$x(x-3) + 12(x-3) = 0$

$(x+12)(x-3) = 0$.

$x = 3$ cm

$x = 3$cm

11. Use matrix method to solve the (3mks)

$3y + 2x = 13$

$2y - 3x = 0$

$2x + 3y = 13$

$-3x + 2y = 0$

Co-eff. matrix $= \begin{pmatrix} 2 & 3 \\ -3 & 2 \end{pmatrix}$

det $= (2\times2) - (-3\times3)$

$= 4 + (+9)$

$= 13.$

Inverse: $\frac{1}{13}\begin{pmatrix} 2 & -3 \\ 3 & 2 \end{pmatrix}$

$\therefore \frac{1}{13}\begin{pmatrix} 2 & -3 \\ 3 & 2 \end{pmatrix}\begin{pmatrix} 2 & 3 \\ -3 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{13}\begin{pmatrix} 2 & -3 \\ 3 & 2 \end{pmatrix}\begin{pmatrix} 13 \\ 0 \end{pmatrix}$

$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$

$\therefore x = 2 \quad y = 3.$ ✓✓

12. The resistance of an electrical conductor is partly constant and partly varies as the temperature. When the temperature is 20°C, the resistance is 55 ohms. When the temperature is 28°C, the resistance is 58 ohms. Find the resistance when the temperature is 60°C (3marks)

$R \propto K + T.$

$\therefore R = K + aT.$

$55 = K + 20a$

$-\ 58 = K + 28a.$

$-3 = 0 - 8a$

$\frac{-8a}{-8} = \frac{-3}{-8}$

$a = 3/8.$

$K = 55 - 20\times 3/8$

$= 47.5$

Equation: $R = 47.5 + 3/8\,T.$

$\therefore$ When $T = 60^{\circ}C.$

$R = 47.5 + (3/8 \times 60)$

≈ 70 ohms. ✓✓

13. (a) Expand and simplify the binomial expression $(2 + x)^5$ upto the term in x^3. (2mks)

Co-efficients of power 5: = 1, 5, 10, 10, 5, 1.

$2^5x^0 \cdot 1 = 32$

$2^4x^1 \cdot 5 = 80x$

$2^3x^2 \cdot 10 = 80x^2$

$2^2x^3 \cdot 10 = 40x^3.$

$(2+x)^5$ to $x^3 = 32 + 80x + 80x^2 + 40x^3.$ ✓

(b) Use your expression to estimate $(1.97)^5$ correct to 4 s.f. (2mks)

$(2+x)^5 = (1.97)^5.$

$x = 1.97 - 2$

$x = -0.03.$

$\therefore (1.97)^5 = 32 + (80x - 0.03) + (80x - 0.03^2) + (40x - 0.03^3)$

$= 32 - 2.4 + 0.072 - 0.00108.$

≈ 29.67 ✓

14. A mixture contains two powders X and Y with masses in the ratio 3:11. If the mixtures Cost Shs.6.70 per kg and powder x costs Shs.5.60 per kg. Find the cost of 1kg of powder Y (3marks)

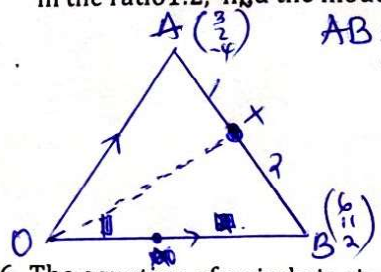
$3/14\,(5.60) + 11/14\,(y) = \text{sh. } 6.70.$

$\text{sh. } 1.2 + 11/14\,y = \text{sh. } 6.70$

$\frac{14}{11}\times\frac{11}{14}y = 5.5\times\frac{14}{11}$

$y \approx \text{shs. } 7.$ ✓

15. Given that O is the origin, OA = 3i + 2j – 4k and OB = 6i + 11j + 2k. If **x** divides AB in the ratio1:2, find the modulus of OX to 2d.p (3marks)



$AB = b - a$

$= \begin{pmatrix} 6 \\ 11 \\ 2 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \\ -4 \end{pmatrix}$

$= \begin{pmatrix} 3 \\ 9 \\ 6 \end{pmatrix}$

$OX = \begin{pmatrix} 3 \\ 2 \\ -4 \end{pmatrix} + \frac{1}{3}AB$

$= \begin{pmatrix} 3 \\ 2 \\ -4 \end{pmatrix} + \frac{1}{3}\begin{pmatrix} 3 \\ 9 \\ 6 \end{pmatrix}$

$= \begin{pmatrix} 3 \\ 2 \\ -4 \end{pmatrix} + \begin{pmatrix} 1 \\ 3 \\ 2 \end{pmatrix}$

$OX = OA + AX = \begin{pmatrix} 4 \\ 5 \\ -2 \end{pmatrix}$

Modulus $OX = \sqrt{4^2 + 5^2 + (-2)^2}$

$= \sqrt{45}$

$= 6.71$ units ✓

16. The equation of a circle is given as $2x^2 + 2y^2 - 8x + 5y + 10 = 0$. Find the radius of the circle and the coordinates of its centre. (3marks)

$\frac{2}{2}x^2 + \frac{2}{2}y^2 - \frac{8}{2}x + \frac{5}{2}y + \frac{10}{2} = 0$

$x^2 + y^2 - 4x + \frac{5}{2}y + 5 = 0$

$(x^2 - 4x + 4) + y^2 + \frac{5}{2}y + \frac{25}{16} = -5 + 4 + \frac{25}{16}$

$(x-2)^2 + \left(y + \frac{5}{4}\right)^2 = \frac{9}{16}$

$(x-a)^2 + (y-b)^2 = r^2$

$a = 2 \quad b = -1.25 \quad r = \sqrt{\frac{9}{16}}$ units

Center $= (2, -1.25)$ ✓

Radius $= 0.75$ units ✓

SECTION B (50MARKS) ANSWER ANY 5 QUESTIONS IN THIS SCTION

17. A youth group decided to raise Ksh 480,000 to buy a piece of land costing Ksh. 80,000 per hectare. Before the actual payment was made, four of the members pulled out and each of those remaining had to pay an additional Kshs. 20,000. 6ha.

(a) If the original number of the group members was **x**, write down;

(i) An expression of how much each was to contribute originally. (1mark)

Ksh. $\frac{480,000}{x}$.

(ii) An expression of how the remaining members were to contribute after the four pulled out. (2marks)

Remaining $= x - 4$.

Each $=$ Ksh. $\frac{480,000}{x-4}$.

(b) Determine the number of members who actually contributed towards the purchase of the land. (4marks)

$\frac{480,000}{x-4} - \frac{480,000}{x} = \text{sh. } 20,000$.

$480,000x - 480,000(x-4) = 20,000(x^2 - 4x)$

$480,000x - 480,000x + 1920000 = 20,000x^2 - 80,000x$

$\frac{20,000x^2}{20,000} - \frac{80,000x}{20,000} - \frac{1920000}{20000} = 0$.

$x^2 - 4x - 96 = 0$

$x = \frac{4 \pm \sqrt{16 - (4x - 96)}}{2}$

$= \frac{4 \pm 20}{2}$

$= 12$ members.

Remaining members $= 12 - 4$

$= 8$ members ✓

(c) Calculate the ratio of the supposed original contribution to the new contribution. (2marks)

Supposed $= \frac{480,000}{12} =$ ksh. 40,000.

New Contribution $= \frac{480,000}{8} =$ ksh. 60,000.

Ratio $= 40,000 : 60,000 = 2 : 3$ ✓✓

(d) If the land was sub-divided equally, find the size of land each member got. (1 marks)

~~ksh~~. No. of ha : $= \frac{480,000}{80,000}$

$= 6$ ha.

Each member $= \frac{6 \text{ ha}}{8} \approx 0.75$ ha. ✓✓

18. a) Two pipes **A** and **B** can fill a tank in 3hrs and 4 hrs respectively. Pipe **C** can empty the full tank in 6 hrs.

i) How long would it take pipes **A** and **B** to fill the tank if pipe **C** is closed(3marks)

In 1 hr, A & B fills $\frac{1}{3} + \frac{1}{4} = \frac{7}{12}$ of the tank:

1 hr $= \frac{7}{12}$

?? $= \frac{12}{12}$

$= \frac{12}{\cancel{12}} \times 1 \times \frac{\cancel{12}^{1}}{7} \approx 1\frac{5}{7}$ hrs: ✓

ii) Starting with an empty tank, how long would it take to fill the tank with all pipes running? (3marks)

All three fill $\frac{1}{3} + \frac{1}{4} - \frac{1}{6} = \frac{5}{12}$ of the tank in 1 hr:

$\therefore$ 1 hr $\approx \frac{5}{12}$.

?? $\approx \frac{12}{12}$.

$= 1 \text{ hr} \times \frac{12}{\cancel{12}} \times \frac{\cancel{12}^{1}}{5}$

$\approx 2\frac{2}{5}$ hrs: ✓✓

b) The high quality Ken coffee is a mixture of pure Arabica coffee and pure Robusta coffee in the ratio 1 : 3 by mass. Pure Arabica coffee costs shs. 180 per kg and pure Robusta coffee costs sh 120 per kg. Calculate the percentage profit when the coffee is sold at sh 162 per kg (4marks)

Cost price (mixture) $=$ sh. $\left(180 \times \frac{1}{4}\right) + \left(\frac{3}{4} \times 120\right)$

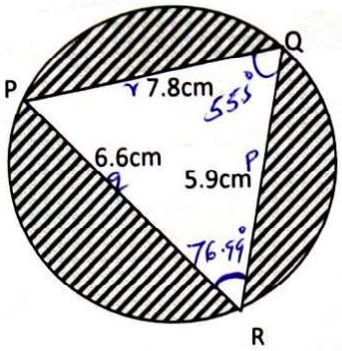
$=$ shs. 135

Profit $=$ sh. $162 - 135$

$=$ sh. 27

% profit $= \frac{27}{135} \times 100 = 20\%$ ✓

19. Triangle **PQR** is inscribed in he circle **PQ**= 7.8cm, **PR** = 6.6cm and **QR** = 5.9cm. Find:



(a) The radius of the circle, correct to one decimal place (3marks)

$7.8^2 = 5.9^2 + 6.6^2 - 2\times6.6\times5.9\cos R$.

$60.84 = 78.37 - 77.88\cos R$.

$\frac{-17.53}{-77.88} = \frac{-77.88\cos R}{-77.88}$

$\angle R = 76.99°$.

$\frac{r}{\sin R} = 2$ Radius.

$\therefore \frac{7.8}{\sin 76.49} = 2r$

$8.\frac{605}{2} = 2r$

Radius $= 4$ cm.

(b) The angles of the triangle (3marks)

$\angle R = 76.99°$.

$\frac{7.8}{\sin 76.49°} = \frac{5.9}{\sin P}$.

$\frac{7.8\sin P}{7.8} = \frac{5.9\times\sin 76.49}{7.8}$

$\angle P = 47.5°$

$\angle Q = 180° - (76.49° + 47.5°)$

$\simeq 55.5°$

(c) The area of shaded region (4marks)

Area of Circle $= \pi r^2$.

$= \frac{22}{7}\times4\times4$

$= 50.29\text{cm}^2$.

Area of Triangle PQR:

$\frac{1}{2}(6.6+5.9+7.8) = 10.15$cm.

$A = \sqrt{10.15(10.15-7.8)(10.15-6.6)(10.15-5.9)}$

$\simeq \sqrt{359.87}$

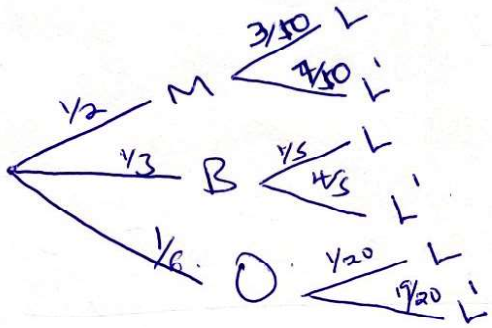
$\simeq 18.97\text{cm}^2$.

Area (shaded Region) $= 50.29 - 18.97\text{cm}^2$

$\simeq 31.32\text{cm}^2$

20. The probability that a boy goes to school by bus is $^1/_3$ and by matatu is ½. If he uses a bus, the probability that he is late to school is $^1/_5$ and if he uses a matatu, the probability of bein late is $^3/_{10}$. If he uses other means of transport, the probability of being late is $^1/_{20}$

(a) Draw a probability tree diagram to represent this information (3marks)



(b) What is the probability that he will be late for school (2marks)

$(ML) + (BL) + (OL)$

$(\frac{1}{2} \times \frac{3}{10}) + (\frac{1}{3} \times \frac{1}{5}) + (\frac{1}{6} \times \frac{1}{20})$

$\frac{3}{20} + \frac{1}{15} + \frac{1}{120}$

$= \frac{9}{40}$

(c) What is the probability that he will be late for school if he does not use a matatu 3marks

$(BL) + (OL)$

$(\frac{1}{3} \times \frac{1}{5}) + (\frac{1}{6} + \frac{1}{20}) = \frac{1}{15} + \frac{1}{120} = \frac{3}{40}$

(d) What is the probability that he is not late for school (2marks)

$P(L') = 1 - P(L) = 1 - \frac{9}{40}$

$= \frac{31}{40}$

21. (a) Fill in the table below for the function $y = -6 + x + 4x^2 + x^3$ for $-4 \leq x \leq 2$ (2marks)

x	-4	-3	-2	-1	0	1	2
-6	-6	-6	-6	-6	-6	-6	-6
x	-4	-3	-2	-1	0	1	2
$4x^2$	64	36	16	4	0	4	16
x^3	-64	-27	-8	-1	0	1	8
y	-10	0	0	-4	-6	0	20

(b) Using the grid provided draw the graph for $y = -6 + x + 4x^2 + x^3$ for $-4 \leq x \leq 2$ 3marks

(c) Use the graph to solve the equations:-

(i) $x^3 + 4x^2 + x - 4 = 0$ (1mark)

$y = -6 + x + 4x^2 + x^3$

$0 = -4 + x + 4x^2 + x^3$

$y = -2$

$x = -3.4, -1.6, 0.9$

(ii) $-6 + x + 4x^2 + x^3 = 0$ (2marks)

$y = -6 + x + 4x^2 + x^3$

$0 = -6 + x + 4x^2 + x^3$

$y = 0$

$x = -3$

$x = -2$

$x = 1$

(iii) $-2 + 4x^2 + x^3 = 0$ (2marks)

$y = -6 + x + 4x^2 + x^3$

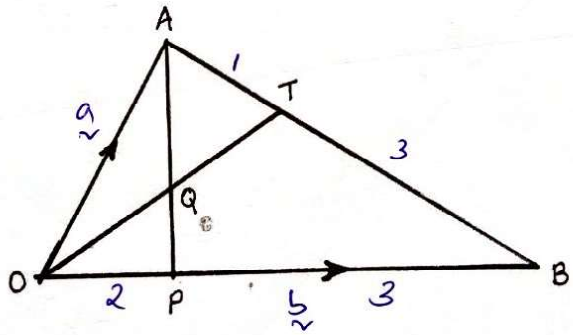
$0 = -2 + 4x^2 + x^3$

$y = -4 + x$

x	0	4
y	-4	0

$x = -3.9, -0.7, 0.7$

22. In the figure below OA = a and OB = b. Points P and T divide $\overline{OB}$ *and* $\overline{AB}$ internally in the ration 2:3 and 1:3 respectively. Lines $\overline{OT}$ *and* $\overline{AP}$ meet at Q.



Find in terms of $\underset{\sim}{a}$ *and* $\underset{\sim}{b}$

(i) *OT*

$\overrightarrow{OT} = \overrightarrow{OA} + \overrightarrow{AT}$

$= \underset{\sim}{a} + \frac{1}{4}(\underset{\sim}{b} - \underset{\sim}{a})$

$= \underset{\sim}{a} + \frac{1}{4}\underset{\sim}{b} - \frac{1}{4}\underset{\sim}{a}$

$\overrightarrow{OT} = \frac{3}{4}\underset{\sim}{a} + \frac{1}{4}\underset{\sim}{b}$ (2mks)

(ii) *OP* (1mark)

$\overrightarrow{OP} = \frac{2}{5}\overrightarrow{OB}$

$\overrightarrow{OP} = \frac{2}{5}\underset{\sim}{b}$

(iii) $\underset{\sim}{AP} = \underset{\sim}{AO} + \underset{\sim}{OP}$ (1mk)

$= -\underset{\sim}{a} + \frac{2}{5}\underset{\sim}{b}$.

* (iv) ~~OQ~~ ~~(1mk)~~

If OQ = kOT and AQ = hAP where k and h are constants express OQ in two different ways and hence find the values of h and k. (6marks)

1st $\underset{\sim}{OQ} = k\left(\frac{3}{4}\underset{\sim}{a} + \frac{1}{4}\underset{\sim}{b}\right)$

$= \frac{3}{4}k\underset{\sim}{a} + \frac{1}{4}k\underset{\sim}{b}$.

2nd $\underset{\sim}{OQ} = \underset{\sim}{OA} + \underset{\sim}{AQ}$

$= \underset{\sim}{a} + h\left(-\underset{\sim}{a} + \frac{2}{5}\underset{\sim}{b}\right)$

$= \underset{\sim}{a}(1-h) + \frac{2}{5}h\underset{\sim}{b}$.

Comparing the two:

$\frac{3}{4}k\underset{\sim}{a} + \frac{1}{4}k\underset{\sim}{b} = \underset{\sim}{a}(1-h) + \frac{2}{5}h\underset{\sim}{b}$.

$\frac{3}{4}k\underset{\sim}{a} = \underset{\sim}{a}(1-h)$

$h = 1 - \frac{3}{4}k$ ---------- (i).

$\frac{1}{4}k\underset{\sim}{b} = \frac{2}{5}h\underset{\sim}{b}$.

$\frac{1}{4}k = \frac{2}{5}h$ ---------- (ii)

$\frac{1}{4}k = \frac{2}{5}\left(1 - \frac{3}{4}k\right)$

$\frac{1}{4}k + \frac{3}{10}k = \frac{2}{5}$

$\frac{11}{20}k = \frac{2}{5}$.

$k = \frac{8}{11}$

$h = 1 - \left(\frac{3}{4} \times \frac{8}{11}\right)$

$h = 5/11$.

23. Income tax for all the income earned was charged at the rates shown.

Total Income p.a (K.£)	Rate in sh per K£
1 – 1980	2
1981 – 3960	3
3961 – 6440	5
6441 – 7920	7
7921 – 9900	9
Excess of 9900	10

(a) Wanyonyi earned a salary of Kshs.10,500 per month. In addition he was given a house allowance of Kshs. 6500 per month. He got tax relief of Kshs. 300 per month.

Find ; (i) His taxable income p.a (2marks)

$= (10,500 + 6500) \times 12$

$=$ Ksh. 204,000 or K£ 10,200.

(ii) Income tax he pays per month. (5marks)

1st 1980 x 2 = sh. 3960
2nd 1980 x 3 = sh. 5940
2480 x 5 = sh. 12,400.
1480 x 7 = sh. 10,360
1980 x 9 = sh. 17,820
800 x 10 = sh. 8000
Total tax = sh. 53,480

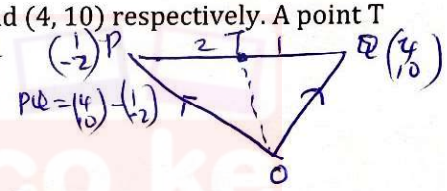
Total tax p.m = sh. $\frac{53480}{12}$
= sh. 4456.67
Net Tax = − 300
= sh. 4156.70

(b) A part from income tax the following deductions are made per month. NHIF of Kshs.320, widow and pension scheme of 2% of his gross salary. Calculate his net monthly pay. (3marks)

Total Deductions = 4156.70 + 320 + $(\frac{2}{100} \times 17000)$
= sh. 4816.70.

Net pay = Shs. 17,000 − 4816.70
= Shs. 12,183.30

24. The coordinates of the points P and Q are (1, -2) and (4, 10) respectively. A point T divides the line PQ in the ratio 2: 1 $PT = \frac{2}{3}PQ$.



$PQ = \begin{pmatrix}4\\10\end{pmatrix} - \begin{pmatrix}1\\-2\end{pmatrix}$

i) Determine the coordinates of T (2marks)

$OT = OP + PT$.
$= \begin{pmatrix}1\\-2\end{pmatrix} + \frac{2}{3}\begin{pmatrix}3\\12\end{pmatrix}$
$= \begin{pmatrix}1\\-2\end{pmatrix} + \begin{pmatrix}2\\8\end{pmatrix} = \begin{pmatrix}3\\6\end{pmatrix}$ ∴ T (3, 6)

ii) Find the gradient of a line perpendicular to PQ (2marks)

Gradient PQ = $\frac{10-(-2)}{4-1}$
= 4

$m_1 \times m_2 = -1$
$4 \times m_2 = -1$
$m_2 = -\frac{1}{4}$

Gradient (Perpendicular to PQ) = $-\frac{1}{4}$

iii) Hence determine the equation of the line perpendicular PQ and passing through T (3marks)

$(x, y), (3, 6)$

$\frac{y-6}{x-3} = -\frac{1}{4}$

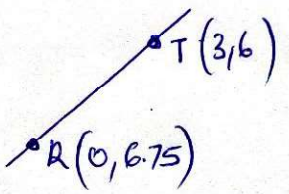
$4y - 24 = -x + 3$

$\frac{4y}{4} = -\frac{x}{4} + \frac{27}{4}$

$y = -\frac{1}{4}x + \frac{27}{4}$

iv) If the line meets the y- axis at R, calculate the distance TR, to three significant figures (3marks)

value of y at R: $y = (\frac{1}{4} \times 0) + \frac{27}{4}$
$y = 6.75$



TR = r − t
$= \begin{pmatrix}3\\6\end{pmatrix} - \begin{pmatrix}0\\6.75\end{pmatrix}$
$= \begin{pmatrix}3\\-0.75\end{pmatrix}$

$|TR| = \sqrt{3^2 + (0.75)^2}$
= 3.09 units