MATHEMATICS
PAPER 1

P1 Q1.

Without using a calculator evaluate, $\dfrac{-2(5+3)-9\div3+5}{-3\times-5+ -2\times4}$ **(3 mks)**

Answer

$$\frac{-2(5+3-9+3+5)}{-3\times-5+(-2)\times4} = \frac{-14}{7} = -2$$

P1 Q 2

Simplify

$$\frac{p^2+2pq+q^2}{p^3-pq^2+p^2q-q^3}$$

Answer

$$\frac{(p+q)(p+q)}{p(p^2-q^2)+q(p^2-q^2)}$$

$$= \frac{(p+q)(p+q)}{(p+q)(p+q)(p\_q)}$$

$$= \frac{1}{p+q}$$

P1 Q 3

The external length, width and height of an open rectangular container are 41 cm, 21 cm and 15.5cm respectively. The thickness of the material making the container is 5mm. If the container has 8 litres of water, calculate the internal height above the water level. (4 mks)
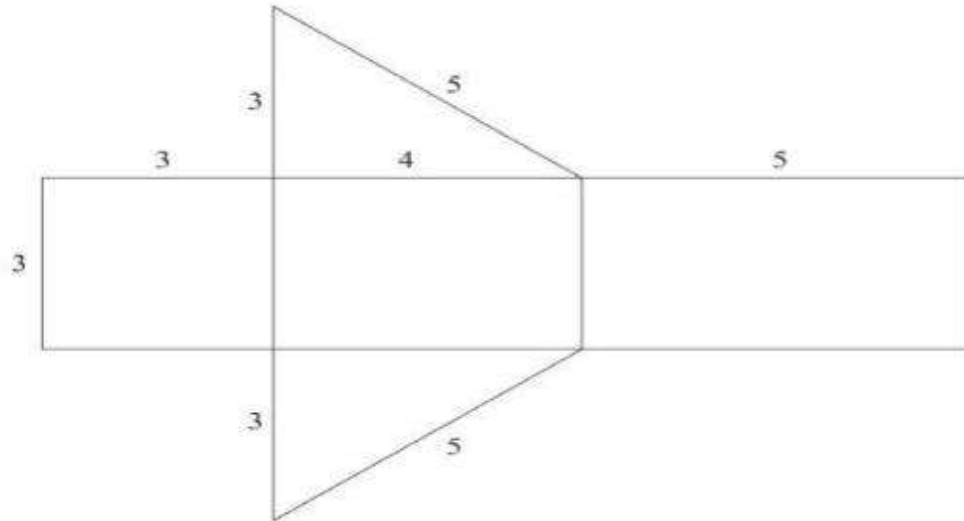
Answer

Internal Dimensions: 40, 20 and 15

Volume unoccupied $= 40\times20 \times 15 - 8000$

$$= 4000$$

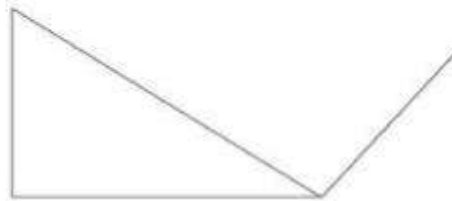Height above water level $= \dfrac{4000}{40\times20} = 5\text{cm}$

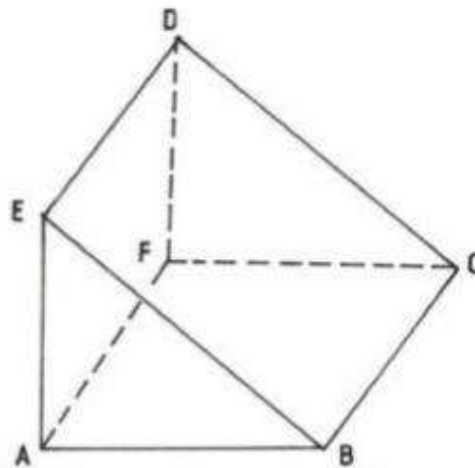The figure below shows a net of a solid. (measurements are in cen_____)

Below is a part of the sketch of the solid whose net is shown above. Complete the sketch of the solid, showing the hidden edges with broken lines.
(3 marks

Answer

PP1 Q 5

Given that **OA** = 2i + 3j and **OB** = 3i – 2j. Find the magnitude of **AB** to one decimal place
(3 marks)

Answer

$$\begin{pmatrix} 3 \\ -2 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} 1 \\ -5 \end{pmatrix}$$

$$\text{magnitude} = \sqrt{1^2 + (-5)^2}$$

$$= \sqrt{26} \simeq 5.1$$

P1 Q6

A bus travelling at an average speed of 63km/h left a station at 8.15 a.m. A car later left the same station at 9.00 a.m. and caught up with the bus at 10.45 a.m. Find the average speed of the car.

Answer

Distance covered by bus

$= \quad 63 \times (10.45 - 8.15)$

$= \quad 63 \times 2.5$

$= \quad 157.5$

Speed of car

$= \quad \dfrac{157.5}{1.75}$

$= \quad 90 \text{ km/h}$

P1 Q7

Given that x is an acute angle and $\cos x = \dfrac{2\sqrt{5}}{5}$, find without using mathematical tables or a calculator, $\tan (90 - x)^0$. (2 marks)

Answer

$$l^2 = 5^2 - (2\sqrt{5})^2 = 5$$

$$l = \sqrt{5}$$

$$\therefore \tan(90 - x)^0 = \frac{2\sqrt{5}}{\sqrt{5}} \quad or \quad 2$$

P1 Q 8

Without using mathematical tables or a calculator, evaluate

$$27^{\frac{2}{3}} \times \left(\frac{81}{16}\right)^{-\frac{1}{4}}.$$

Answer

$$27^{\frac{2}{3}} \times \left(\frac{81}{16}\right)^{-\frac{1}{4}} = \left(3^3\right)^{\frac{2}{3}} \times \left(\frac{3^4}{2^4}\right)^{-\frac{1}{4}}$$

$$= 3^2 \times \left(\frac{3}{2}\right)^{-1}$$

$$= 3^2 \times \frac{2}{3}$$

$$= 6$$

P1 Q 9

A minor arc of a circle subtends an angle of 105° at the centre of the circle. If the radius of the circle is 8.4 cm, find the length of the major arc. (Take $\pi = \frac{22}{7}$)

(3 marks)

Answer

Angle for major arc $= 360 - 105$

$= 255°$

Length of arc $= \frac{255}{360} \times 2 \times 8.4 \times \frac{22}{7}$

$= 37.4$ cm

P1 Q10

The gradient of the tangent to the curve y = ax³ + bx at the point (1,1) is -5. Calculate the values of a and b   (4 marks)

Answer

$$\frac{dy}{dx} = 3ax^2 + b$$

$3a + b = -5$

$a + b = 1$

$a = -3$

$b = 4$

A line with gradient of -3 passes through the points (3, k) and (k,8). Find the value of k and hence express the equation of the line in the form of ax + by = c, where a, b, and c are constants.

Answer

$$\frac{k-8}{3-k} = \frac{-3}{1}$$

$$k-8 = -9 + 3k$$
$$2k = 1$$
$$K = \tfrac{1}{2}$$

$$\frac{y-8}{x-\tfrac{1}{2}} = \frac{-3}{1}$$

$$y-8 = -3(x-\tfrac{1}{2})$$
$$y-8 = -3x + \frac{3}{2}$$
$$2y-16 = 6x + 3$$
$$6x +2y = 19$$

P1 Q 12

Points L and M are equidistant from another point K. The bearing of L from K is 330^0. The bearing of M from K is 220^0. Calculate the bearing of M from L (3 marks)

Answer

$\angle LKM = 110°$

$\angle KLM = 35°$ OR $KML = 35°$

Bearing is 185°

P1 Q 13

In this question, mathematical tables should not be used.
A Kenyan bank buys and sells foreign currencies as shown below

Buying (In Kenya shillings)	Selling In Kenya Shillings
1 Hong Kong dollar	
9.74	9.77
1 South African rand	
12.03	12.11

A tourist arrived in Kenya with 105 000 Hong Kong dollars and changed the whole amount to Kenyan shillings. While in Kenya, she spent Kshs 403 897 and changed the balance to South African rand before leaving for South Africa. Calculate the amount, in South African rand that she received. (3 marks)

Answer

$$105000 \times 9.74$$
$$= sh\ 1022700$$
$$\frac{1022700 - 403879}{12.11}$$
$$= \frac{618821}{12.11}$$
$$= 51100\ rands$$

P1 Q 14

A small cone of height 8 cm is cut off from a bigger cone to leave a frustum of height 16cm. If the volume of the smaller cone is 160cm3, find the volume of the frustum **(3marks)**

> **Answer**
>
> L.S.F. = 8: 24 = 1: 3
>
> V.S.F = 1: 27
>
> Volume of frustum = $160 \times 27 - 160$
>
> $= 4160 \, cm^3$

PP1 Q 15

The production of milk, in litres, of 14 cows on a certain day was recorded as follows: 22, 26, 15, 19, 20, 16, 27, 15, 19, 22, 21, 20, 22 and 28.
Determine:

(a) the mode; **(1 mark)**

> **Answer**
>
> Mode
>
> = 22

(b) the median. **(2 marks)**

> **Answer**
>
> Median
>
> 15, 15, 16, 19, 19, 20, 20, 21, 22, 22, 22, 26, 27, 28
>
> median $= \dfrac{20 + 21}{2}$
>
> = 20.5

P1 Q 16

Given that log 4=0.6021 and log 6=0.7782, without using mathematical tables or a calculator, evaluate log 0.096. **(3mks)**

> **Answer**
>
> $\text{Log } 0.096 = \text{Log}\left(4^2 \times 6 \times 10^{-3}\right)$
>
> $= 2(0.6021) + \bar{3}.7782$
>
> $= \bar{2}.9824 \text{ or}$
>
> (-1.0176)

P1 Q 17

(a) Solve the equation, $\dfrac{x+3}{24} = \dfrac{1}{x-1}$ **(4 marks)**

> **Answer**
>
> X = 5 or - 6

(b) The length of a floor of a rectangular hall is 9 m more than i~~MANYAM FRANCHISE~~
area of a floor is 136 m2.

  (i) Calculate the perimeter of the floor.   *(4 marks)*

    Answer

        50 m

  (ii) A rectangular carpet is placed on the hall leaving an area of 64 m2. If the length of the carpet is twice its width, determine the width of the carpet. *(2 marks)*

    Answer

        6 m

PP No.18.

Three business partners: Asha, Nangila and Cherop contributed Ksh 60 000, Ksh 85 000 and Ksh 105 000 respectively. They agreed to put 25% of the profit back into business each year. They also agreed to,put aside 40% of the remaining profit to cater for taxes and insurance. The rest of the profit would then be shared among the partners in the ratio of their contributions.

At the end of the first year, business realized a gross profit of Ksh 225 000

  (a) Calculate the amount of money Cherop received more than Asha at the end of the first year.   *(5 marks)*

      Answer

% Profit for taxes and insurance

$$= \frac{40}{100} \times \frac{75}{100}$$

Amount shared

$$= \frac{100 - (25 + 30)}{100} \times 225000$$

$$= \frac{45}{100} \times 225000$$

$$= 101250$$

Amount Cherop received more than Asha: Ratio of contribution

60000: 85000: 105000

12   : 17 : 21

$$\frac{21 - 12}{50} \times 101250$$

$$= 18225$$

(b) Nangila further invested Ksh 25 000 into the business at the beginning of the second year. Given that the gross profit at the end of the second year increased in the ratio 10:9, calculate Nangila's share of the profit at the end of the second year.

                                                        (5 marks)

Answer

Profit during 2nd year:

$225000 \times \dfrac{10}{9}$

$= 250000$

Nangila's new ratio:

$= \dfrac{110000}{275000} = \dfrac{2}{5}$

$\therefore$ Nangila's New Share of Profit

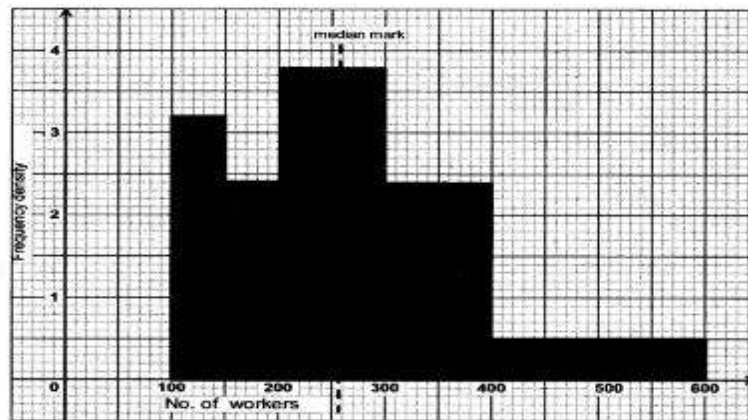$= \dfrac{2}{5} \times 112500$

$= 45000$

P1 Q19

The frequency table below shows the daily wages paid to casual workers by a certain company

Wages in shillings	100-150	150-200	200-300	300-400	400-600
No. of workers	160	120	380	240	100

a) Draw a histogram to represent the above information. (5 marks)

Answer

Frequency (f)	160	120	380	240	100
Class width(c)	50	50	100	100	200
Freq. density(f/c)	3.2	2.4	3.8	2.4	0.5

(b)(i)State the class in which the median wage lies. (1 mark)

    Answer

        median class: 200 – 300

(ii)Draw a vertical line, in the histogram, showing where the median wage lies. (1 mark!
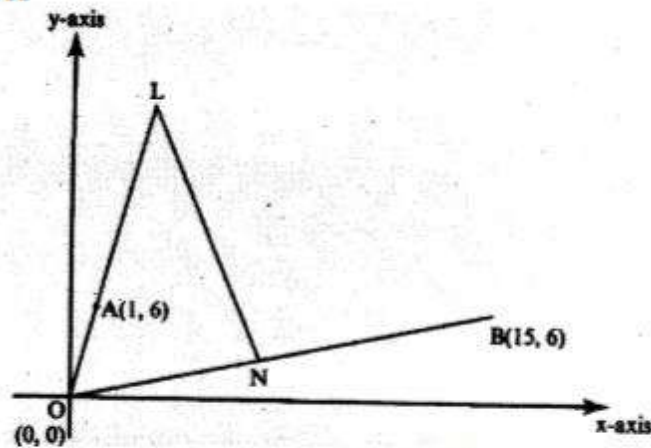
    Answer

        Shown by dotted line (257.895)

(c)Using the histogram, determine the number of workers who earn sh 450 or less per day.   **(3 mark;**

    Answer

        Number of workers who earn Sh. 450 or less per day $= 900 + 50 \times 0.5 = 925$

P1 Q 20

In the diagram below, the coordinates of points A and B are (1,6) and (15,6) respectively). Point N is on OB such that 3 ON = 2OB. Line OA is produced to L such that OL = 3 OA

a)Find vector LN   **(3 marks)**

    Answer

$$OL = 3\begin{pmatrix} 1 \\ 6 \end{pmatrix}$$

$$= \begin{pmatrix} 3 \\ 18 \end{pmatrix}$$

$$ON = \frac{2}{3}\begin{pmatrix} 15 \\ 6 \end{pmatrix}$$

$$= \begin{pmatrix} 10 \\ 4 \end{pmatrix}$$

$$LN = ON - OL$$

$$= \begin{pmatrix} 10 \\ 4 \end{pmatrix} - \begin{pmatrix} 3 \\ 18 \end{pmatrix}$$

$$= \begin{pmatrix} 7 \\ -14 \end{pmatrix}$$

(b) Given that a point M is on LN such that LM: MN = 3: 4, find 's of (2 marks)

Answer

$$OM = OL + \frac{3}{7}LN$$

$$= \begin{pmatrix} 3 \\ 18 \end{pmatrix} + \frac{3}{7}\begin{pmatrix} 7 \\ -14 \end{pmatrix}$$

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

$$= \begin{pmatrix} 6 \\ 12 \end{pmatrix}$$

$$= M(6,12)$$

(c) If line OM is produced to T such that OM: MT = 6:1

(i) Find the position vector of T (1 mark)

Answer

$$OT = \frac{7}{6}OM$$

$$= \frac{7}{6}\begin{pmatrix} 6 \\ 12 \end{pmatrix}$$

$$= \begin{pmatrix} 7 \\ 14 \end{pmatrix}$$

(ii) Show that points L, T and B are collinear (4 marks)

Answer

$$LT = \begin{pmatrix} 7 \\ 14 \end{pmatrix} - \begin{pmatrix} 3 \\ 18 \end{pmatrix}$$

$$= \begin{pmatrix} 4 \\ -4 \end{pmatrix}$$

$$LB = \begin{pmatrix} 15 \\ 6 \end{pmatrix} - \begin{pmatrix} 3 \\ 18 \end{pmatrix}$$

$$= \begin{pmatrix} 12 \\ -12 \end{pmatrix}$$

$$LB = 3LT$$

L is the common point.

(a) The ratio of Juma's and Akinyi's earnings was 5 : 3. Juma's e........ ..... Ksh 8400 after an increase of 12%. Calculate the percentage increase in Akinyi's earnings given that the sum of their new earnings was Ksh 14 100. **(6 marks)**

Answer

Juma's earnings before increase:

$112\% \rightarrow 8400$

$100\% \rightarrow 8400 \times \dfrac{100}{112}$

$\qquad\qquad = 7500$

Akinyi's earnings before increase:

$\dfrac{3}{5} \times 7500 = 4500$

Increase in Akinyi's earnings

$14100 - 8400 - 4500$

$\qquad\qquad = 1200$

% increase in Akinyi's earnings

$\dfrac{1200}{4500} \times 100$

$\qquad = 26\tfrac{2}{3}$

(b) Juma and Akinyi contributed all the new earnings to buy maize at Ksh 1175 per bag. The maize was then sold at Ksh 1 762.50 per bag. The two shared all the money from the sales of the maize in the ratio of their contributions. Calculate the amount that Akinyi got. **(4 marks)**

Answer

No. of bags bought

$\dfrac{14100}{1175}$

$= 12$ bags

Profit $= (1762.50 - 1175) \times 12 = 7050$

Ratio $\quad 5700 : 8400 = 19 : 28$

Profit for Akinyi: $= 7050 \times \dfrac{19}{47} = 2850$

Total earning for Akinyi:

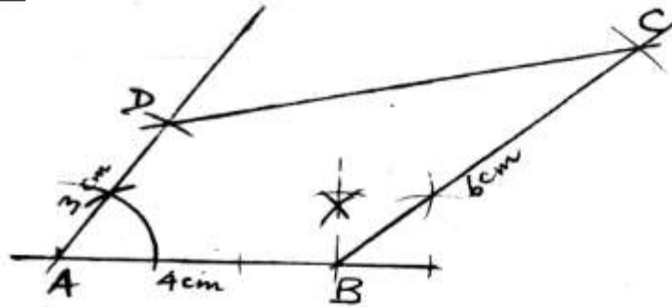$5700 + 2850$

$\qquad = 8550$

Using a pair of compasses and ruler only, construct a quadrilateral A____ __ _____ AB = 4 cm, BC = 6 cm, AD = 3 cm, angle ABC = 135° and angle DAB = 60°. Measure the size of angle BCD. **(4 marks)**

Answer

Construction of 135⁰ angle between lines AB = 4 cm and BC = 6 cm

Construction of 60⁰ angle between lines AB = 4 cm and AD = 3 cm

Completion of quadrilateral ABCD

$\angle BCD = 31° \pm 1°$

P1 Q 23

The equation of a curve is $y = 2x^3 + 3x^2$.

(a) Find:
   (i) The x-intercept of the curve; (2 marks)

Answer

x - intercepts

when y= 0

$x^2(2x + 3) = 0$

$x = 0 \ and \ x = -\frac{3}{2}$

(ii) The y- intercept of the curve;   (1 mark)

Answer

y - intercept

when x = 0, y = 0

(b)(i)Determine the stationary points of the curve.(3 marks)
  <u>Answer</u>

stationary points of curve

$$\frac{dy}{dx} = 6x^2 + 6x$$

stationery points when $\frac{dy}{dx} = 0$

i.e. $6x^2 + 6x = 0$

$6x(x + 1) = 0$

$x = 0 \; or \; x = -1$

∴ stationary points are:

$(0,0)$ and $(-1,1)$

(ii) For each points in (b) (i) above, determine whether it is a maximum or minimum,   (3 marks)
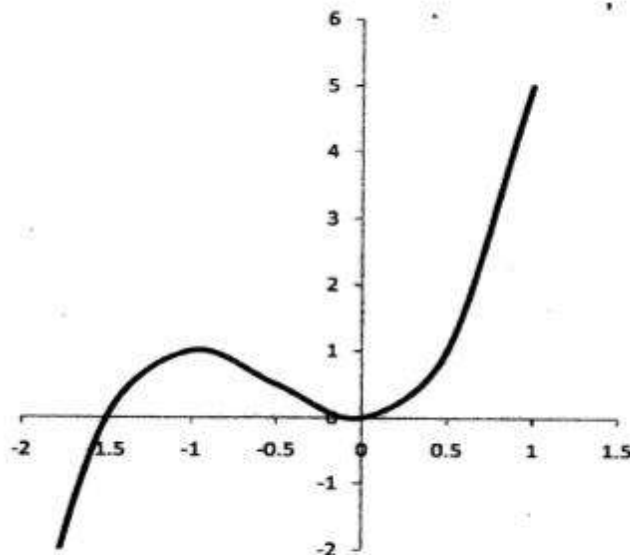 <u>Answer</u>

x	-2	$-1\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1
$\frac{dy}{dx}$	12	$4\frac{1}{2}$	0	$-1\frac{1}{2}$	0	$4\frac{1}{2}$	12

minimum point (0,0)
maximum point (-1,1)

(c) Sketch the curve. (2 marks)
  <u>Answer</u>

points plotted at $\left(-1\frac{1}{2},0\right),(-1,1) \; and \; (0,0)$

smooth curve

P1 Q 24

(a)On the grid provided, draw a graph of the function $y = \frac{1}{2}x^2 - x + 3$ for $0 \leq x \leq 6$

(grid was provided)   (3 marks)

<u>Answer</u>

x	0	1	2	3	4	5	6
$y = \frac{1}{2}x^2 - x + 3$	3	2½	3	4½	7	10½	15