NATIONAL BUSINESS AND TECHNICAL EXAMINATION BOARD

NTC / NBC EXAMINATION MAY / JUNE, 2008

1(a) Simplify $\frac{1¼}{2 + ¼ \text{ of } 28}$

(b) The sides of a triangle are in the ratio 4:7:8 and its perimeter is 38cm. Find the sides.

Solution

(a) $2 + \frac{1}{4} of\ 28 = 2 + \frac{1}{4} \times 28 = 2 + 7 = 9$

$for 1\frac{1}{4} \div 9 = \frac{5}{4} \div 9 = \frac{5}{36}$

(b) Total ratio = 4 + 7 + 8 = 19

Getting: $\frac{38}{19}$ x 4 = 8cm

$\frac{38}{19}$ x 7 = 14cm

$\frac{38}{19}$ x 8 = 16cm

2. Find the value of x and y in the following equations:

$32_x + 51_y = 10_{10}$
$23_x + 42_y = 7_{10}$

Solution

(3x + 2) + (5y + 1) = 10 $\Rightarrow$ 3x + 5y = 7
(2x + 3) + (4y +2) = 7 $\Rightarrow$ 2x + 4y = 2

Solving the set of equations, we have x = 9 and y = -4

3.(a) If $4^{\frac{3x}{2}} = \frac{\sqrt{8^x}}{4}$, find x.

(b) A shopkeeper gained 8% by selling a table for ₦2,700.00. What is the cost price of the table?

Solution

(a) $4^{\frac{3x}{2}} = \frac{\sqrt{8^x}}{4}$, find x

$4^{\frac{3x}{2}} = \left(2^2\right)^{\frac{3x}{2}} = 2^{3x}$

$\frac{\sqrt{8^x}}{4} = \frac{2^{\frac{3x}{2}}}{2^2} = 2^{\frac{3x}{2}-2}$

$\therefore 2^{3x} = 2^{\frac{3x}{2}-2}$

Getting $3x = \frac{3x}{2} - 2 \Rightarrow x = -\frac{4}{3} or -1\frac{1}{3}$

(b) Selling price = 108% = ₦2,700

Cost price = 100% = $\frac{100}{108}$ x ₦2,700 = ₦2500

4(a) Simplify $\log_3 54 + \log_3 15 - \log_3 10$

(b) If -8, x, y, 19 are a sequence in arithmetic progression (A.P), find the value of x and y

Solution

(a) $\log_3 54 + \log_3 15 - \log_3 10 = \log_3\left(\frac{54 \times 15}{10}\right) = \log_3 81$

$\log_3 81 = \log_3 3^4 = 4\log_3 3 = 4$

(b) $T_4 = 19 = -8 + (4 - 1)d$

Solving to get d = 9

x = - 8 + 9 = 1, y = 1 + 9 = 10

ALITER: d = x + 8 = y - x $\Rightarrow$ 2x - y = - 8

or 19 – y = y - x $\Rightarrow$ - x + 2y = 19

Solving simultaneously, we have

2x – y = - 8…… (1)

-x + 2y = 19 …….. (2)

2x –y = -8…… (1) x 2

-x + 2y = 19 ……..... (2) x 1

4x – 2y = -16

-x + 2y = 19

3x = 3

x = 1

Substitute for x in equation (1)

2x –y = - 8

2(1) – y = -8

-y = -8 – 2

-y = -10 $\Rightarrow$ y = 10

5. (a) A diagonal of a rectangle is 15cm. If the length is 3cm greater than the breath, find the perimeter of the rectangle.

(c) The exterior angles of a pentagon are $4x^0$, $3x^0$, $(x - 60)^0$, $2x^0$ and 50^0, find the value of x

(d)

Solution

(a) Let the breadth be x cm, then length = (x +3) cm
we have $152 = x^2 + (x+3)^2 \quad \Rightarrow \quad x^2 + 3x - 108 = 0$
Solving, we get x = 9 or -12
Perimeter = 2(9+12) cm = 42cm

(b) $4x^o + 3x^o + (x - 60)^o + 2x^o + 50^o = 360^o$
Solving, we get $x = 37^0$

6(a) Express U in terms of V and W in the equation:

$$\frac{V}{\sqrt{3}} = \frac{U}{U+W}$$

(b) In a school, 115 students sat for an examination and the results were as follows: Six - nine students passed Physics, 70 passed Chemistry and 80 passed Mathematics. Of these, 45 passed both Chemistry and Mathematics and 44 passed both Mathematics and Physics. Given that 14 of them passed all the three subjects, find the number of students who passed ONLY

(i) Physics
(ii) Chemistry
(iii) Mathematics, and
(iv) One of three subjects.

Solution

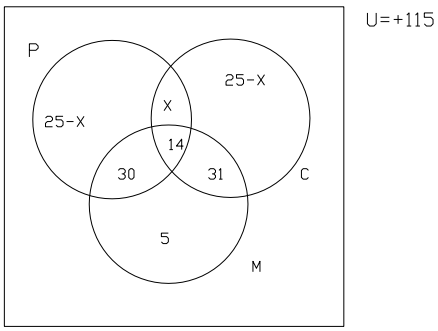
(a) Removing the fraction: $V(U+W) = \sqrt{3}\ U$

$VU + VW = \sqrt{3}\ U$

$\sqrt{3}\ U - VU = VW$

$(\sqrt{3} - V)\ U = VW$

$$U = \frac{VW}{\sqrt{3} - V}$$



(b)

$80 + 25 – x + x + 25 - x = 115$

Solving we get $x = 15$

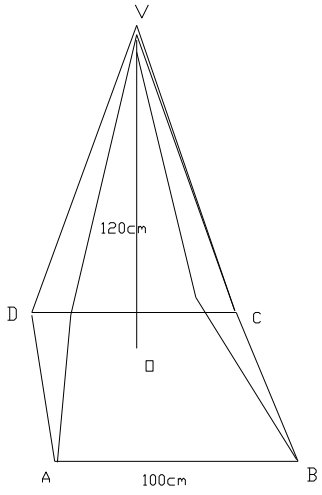
(i) Physics only = $25 - 15 = 10$

(ii) Chemistry = $25 - 15 = 10$

(iii) Mathematics only = 5

(iv) One of the three subjects = $10 + 10 + 5 = 25$

7. VABCD is a solid pyramid on a square base ABCD and has vertex V. The height of the pyramid, VO, is 12cm and the length AB is 10cm.

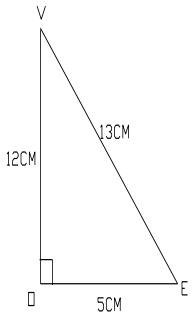


Calculate the:

(a) total surface area and

(b) volume, of the pyramid.

Solution



If VE is the height of any of the
Δ lar faces. $VE^2 = 12^2 + 5^2$
VE = 13
(Accept the use of Pythagoras' triple)

Area of each of the triangular faces = 4 x $65cm^2$ = $260cm^2$
Area of the square base = $100cm^2$
(a) Total surface area = (260 + 100) cm^2 = $360cm^2$
(b) Volume = (1/3 x 12 x 100) cm^3 = $400cm^3$

8.(a) Two perfect dice are thrown together. Calculate the probability that the sum is
(i) 9 or 10
(ii) at most 5

(b) An aero plane flies at 650km per hour along the parallel of latitude from a point X (15^oS, $10^o W$) to Y (15^oS, 48^oE). Calculate the time spent by the aero plane to fly from X to Y to the nearest 1 hour (Take R = 6400km and π = 3.142).

Solution

(a) Prob. (sum = 9) = $\frac{4}{36} = \frac{1}{9}$

Prob (sum = 10) = $\frac{3}{36} = \frac{1}{12}$

(i) Prob (sum = 9 or 10) = $\frac{1}{9} + \frac{1}{12} = \frac{7}{36}$

(ii) At most 5, we have (1,1) (1,2) (1,3) (1,4) (2,1) (2,2) (2,3) (3,1) (3,2) and (4,1)

Prob. (sum = at most 5) = $\frac{10}{36} = \frac{5}{18} = 0.28$

(b) R = 6400 Cos15^o = 6181.8
Angle between X and Y along the parallel = 58^0.

Distance XY = $\frac{58^0}{360^0}$ x 2 x 3.142 x 6181.8
Simplifying to get /XY/ = 6258.55
Time spent = $\frac{6258.55}{650}$ = 9.6 hours
= 10 hrs to the nearest 1 hr.

9. Using a ruler and a pair of compasses only, construct a triangle PQR in which < PQR = 30^o, /PQ/ = 7cm and /PR/ = 8cm.
(a) Construct a locus *l* which is always 5cm from the point P and which intercepts PQ and PR at M and N respectively.
(b) What type of shape is MNRQ?
(c) Construct line QX, the shortest distance from Q to PR
(d) Measure /QX/ and <PQR

Solution

For constructing /PQ/ = 7cm
For constructing <PQR = 30^o
For completing Δ PQR and /PR/ = 8cm
(a) For locus *l* = circle of radius 5cm. Drawing line MN to have MNRQ
(b) The shape of MNRQ is a quad or trapezium.
(c) Constructing $\perp$ from Q to PR
(d) For /QX/ = 5.8 $\pm$ 0.2cm
<PQR = 30^o

10 (a) Use logarithm tables to evaluate

$\sqrt{\frac{(3.415)^4 \times 28.91}{0.267}}$, correct to 3 significant figures

(b) Given that $\log_{10}2 = 0.3010$ and $\log_{10}7 = 0.8451$, evaluate, without the use of tables, $\log_{10}3.92$

Solution

(a)

Number	Log
3.415	0.5334
$(3.415)^4$	2.1336
28.91	1.4611(+)
	3.5947
0.267	$\bar{1}$.4265 (-) 4.1682÷ 2
121.3	2.0841

Anti log of 2.0841 = 121.3
= 121 correct to 3 significant figures

(b) $\log_{10} 3.92 = \log_{10} \frac{392}{100} = \log_{10} 2^3 + \log_{10} 7^2 - \log_{10} 10^2$

$= 3\log_{10}2 + 2\log_{10}7 - 2\log_{10}10$
$= (3 \times 0.3010) + (2 \times 0.8451) - 2$
$= 2.3932 - 2$
$= 0.5932$

11 Construct a table of values for $-1 \leq x \leq 5$ for the function $y = 2x^2-7x - 4$

(a) Using your table of values, plot the graph of $y = 2x^2-7x - 4$ taking 2cm to represent 1 unit and 4 units on the x-axis and y-axis respectively.

(b) On the same axes and with the same scale, draw the graph of $y = 3x+1$

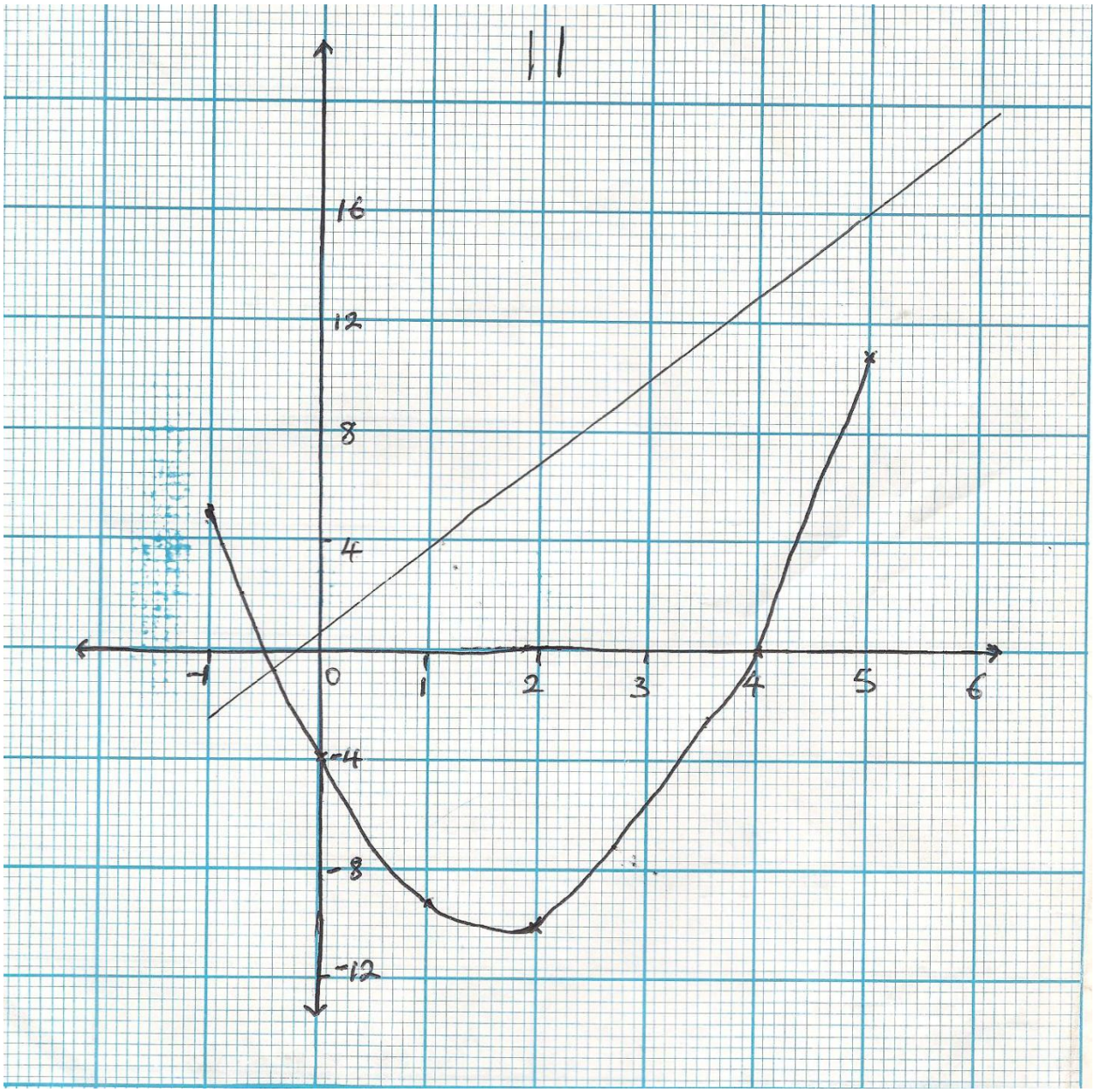
(c) Use your graphs to find the

(i) least value of $y = 2x^2 - 7x - 4$ and the corresponding value(s) of x

(ii) roots of the equation $2x^2 - 10x - 5 = 0$

Solution

x	-1	0	1	2	3	4	5
y	5	-4	-9	-10	-7	0	11



For correct axes and scale plotting his points (-½ for each error)

(c) Drawing line $y = 3x + 1$

(d) Least value = -10.02 ± 0.05

Corresponding value of $x = 1.85 \pm 0.05$

Root of equation $2x^2 - 10x - 5 = 0$

$x = -0.4 \pm 0.05$

12(a) Below are amounts of money given to 15 students as gifts in a school, in Nigeria

2, 3, 7, 5, 3, 9, 5, 6, 4, 5, 6, 6, 7, 5, 9

Calculate:

(i) mean

(ii) mode, and

(iii) median, to the nearest ten kobo

(b) Three men provided capitals of ₦1000.00, ₦2000.00 and ₦6000.00 for a business on the understanding that the shares of the profit were proportional to the capital provided. If the profits were ₦450.00, what should each receive?

Solution

(a) ₦ [2 + (3 x 2) + 4 + (5 x 4) + (6 x 3) + (7 x 2) + (9 x 2)] = ₦82

Mean = ₦82 = ₦5.47
15

= ₦5.50

(ii) Mode = ₦5.00

(iii) The 8th term after arranging in ascending order of magnitude, median = ₦5.00

(b) Ratio of sharing: ₦1000: ₦2000: ₦6000 or 1:2:6

Share profit = 1/9 x ₦450 = ₦50.00

= 2/9 x 450 = 100.00

= 6/9 x 450 = ₦300.00

13(a) If ₦1,680.00 amounts to ₦1,890.00 at 5% per annum, find the time of interest.

(b) The rateable value of a town is ₦438,400.00. The local council has to estimate for an increase of ₦15,600.00 in Education costs. What is the rate of this increase, to the nearest half kobo?

(c) A good costing 300 dollars was imported into Nigeria. If ₦150.00 was exchanged for 1 dollar and an import duty of 9½% was paid, find, in Naira, the
(i) duty paid on the good, and
(ii) selling price of the good in order to make 20% profit.

Solution

(a) Profit = ₦1890 - ₦1680 = ₦210

Time of interest = 100 x 210 year
1680 x 5

Simplifying we get 2½ years.

(b) Rate of the increase = 15600 x 100k
438,400

= 3.558k = 3½ k

(c) Cost of good in Naira = 300 x ₦150

= ₦45000.00

(d) Import duty = 19 x 45000

200
= ₦4,275.00

(e) Total cost of importing the good = ₦ (45000 + 4275)
= ₦49,275.00

Selling price to make 20% gain
= 120 x ₦ 49275
100
= ₦59,130.00

14. A man buys a car worth ₦250,000.00 on hire purchase. He pays ₦100,000.00 on delivery and is to pay the balance at an installment of ₦40,000.00 yearly for three years. If compound interest is charged at 5% per annum by the seller, calculate the:

(a) amount he pays for the car
(b) balance he is to pay and
(c) company's percentage profit, at the end of the three years.

Solution

$I = \frac{PTR}{100}$

Amount to pay interest on = 150,000
1st year: Interest = 5% of 150,000 = 7,500
Balance after paying ₦40,000 = ₦ (150,000 + 7500 – 40,000)
= ₦117,500

2nd year: Interest = 5 x 117,500
100
= ₦5875
Balance ₦ (123, 375 – 40,000) = ₦83,375 (Note: 117, 500 + 5, 875 = 123, 375)

3rd year: interest = 5 x ₦83,375
100
= 4168.75
Balance = (87,543.75 – 40,000)

= ₦47,543.75
Total interest = ₦ (7,500 + 5,875 + 4,168.75)
= ₦17,543.75

(a) He pays = ₦ (250,000 + 17,543.75)
=₦267,543.75

(b) Balance he is to pay = ₦ (87,543.75 – 40,000)
= ₦ 47,543.75

(c) Percentage profit he is to pay

$$= \frac{17543.75}{250{,}000} \times 100$$

$$= 7.02\% \approx 7\%$$

15. A man bought ₦12,000.00 4% stock at 85 and 800 75k shares at 90k each. If the broker's commission was ½ % on the stock and 1¼% per share on shares, calculate the:

(i) broker's commission on the stock and shares

(ii) total amount invested, and

(iii) yearly income derived from the stock

Solution

Stock: ₦12,000 paid = market value + Broker's commission

Broker's commission = ½ % = 0.5%

∴ market value (consideration) $= \frac{100}{100.5} \times$ ₦12,000

= ₦11,940.30

∴ brokers commission = ₦(12,000 – 11,940.30)

= ₦59.70

Nominal value $= \frac{100}{85} \times$ ₦11,940.30

= ₦14,047.41

Shares: Market Value $= \frac{90}{100} \times$ ₦800

=₦ 720

Nominal Value $= \frac{75}{100} \times$ ₦800

= ₦600

Broker's Commission $= \frac{5}{400} \times 720$

= ₦9

(i) Broker's total commission = (59.70 + 9)

=₦68.70

(ii) Total amount invested = ₦12,000 + ₦720 + ₦9 = ₦12,729

(iii) Yearly income from stock $= \frac{4}{100} \times 14047.41$

= ₦5,618.96