RELEVANT FORMULAE IN WAEC/NECO MATHEMATICS

Arithmetic Progression (A.P.) formulas

nth term: $T_n = a + (n-1)d$

Sum of nth term: $S_n = \frac{n}{2}\{2a + (n-1)d\}$ or $S_n = \frac{n}{2}(a + L)$

Note: L is the last term

Geometric Progression (G.P.) formulas:

nth term: $T_n = ar^{n-1}$

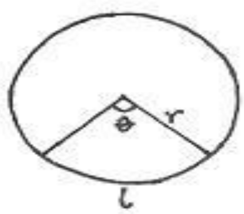
Sum of nth term: $S_n = \frac{a(1 - r^n)}{l - r}$ (if r < 1)

or $S_n = \frac{a(r^n - 1)}{r - 1}$ (if r > 1)

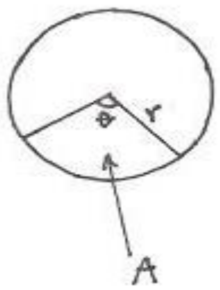
Sum to infinity: $S_\infty = \frac{a}{l - r}$ (if $|r| < 1$)

Circle Geometry Formulas

Length of an arc: $L = \frac{\theta}{360} \times 2\pi r$



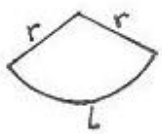
Area of a sector: $A = \frac{\theta}{360} \times \pi r^2$



Also,

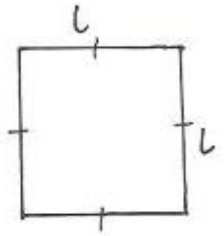
Area of a sector: $A = \frac{Lr}{2}$

Perimeter of sector: $P = L + 2r$



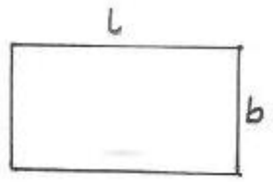
Geometry Formulas

Perimeter of a square: P = 4L (if each side is L)



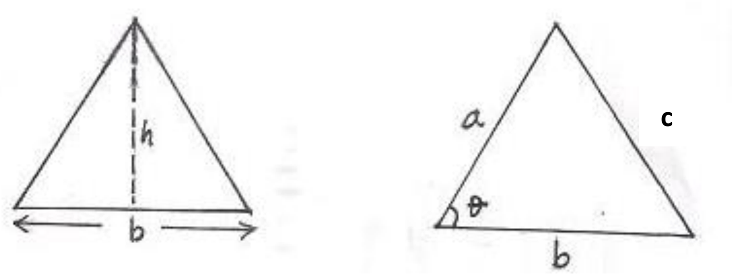
Area of a square: A = l x l = l^2

Perimeter of a rectangle: P = 2(l + b)



Area of a rectangle: A = l x b

Perimeter of a triangle: P = Sum of three sides



Area of a triangle: A = ½ x base x perpendicular height

i.e. A= $^{1}/_{2}$bh or

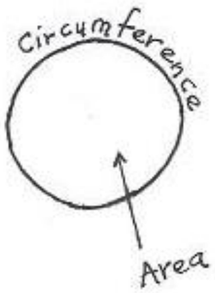
A = ½ absin θ (where a and b are adjacent sides with included angle θ)

Or using **Hero's Formula**:

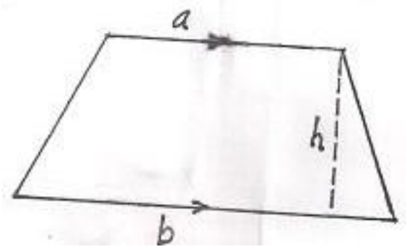
Area = $\sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$

Circumference of a circle: C = 2πr

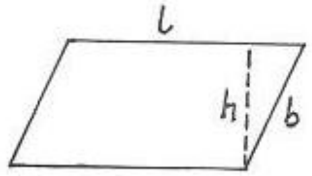
Area of a circle: A = πr^2



Area of trapezium: $A = \frac{1}{2}(a + b)h$ (where a and b are parallel sides)



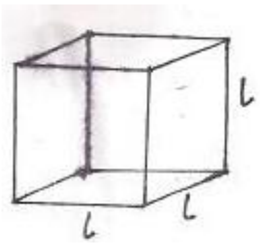
Perimeter of a parallelogram: $P = 2(L + b)$



Area of a parallelogram: A = length x perpendicular height

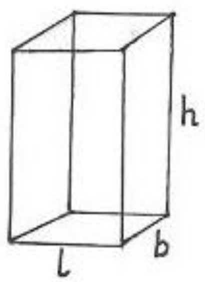
i.e. $A = L \times h$

Volume of a cube: $V = L \times L \times L = L^3$



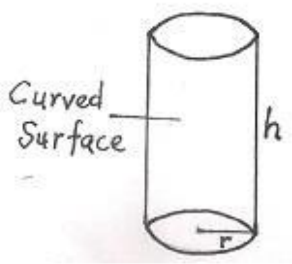
Total surface area of a cube: $A = 6l^2$

Volume of a cuboid: $V = l \times b \times h = lbh$



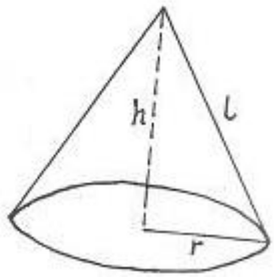
Total Surface Area of a cuboid: $TSA = 2(lb + bh + lh)$

Volume of a cylinder: $V = \pi r^2 h$



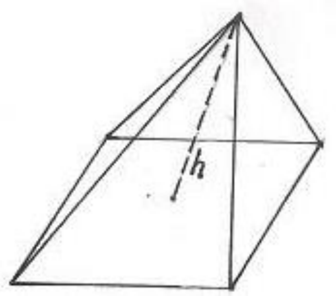
Curved Surface Area of a cylinder: CSA $= 2\pi rh$
Total Surface Area of a closed cylinder: TSA $= 2\pi r^2 + 2\pi rh$
$= 2\pi r(r + h)$

Volume of a cone: $V = (^1/_3)\,\pi r^2 h$

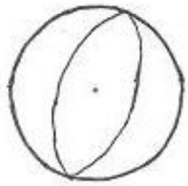


Curved Surface Area of a cone: CSA $= \pi rL$
Total Surface Area of a closed cone: TSA $= \pi r^2 + \pi rL$
$= \pi r(r + L)$

Volume of a pyramid: $V = \frac{1}{3}$ x base area x perpendicular height

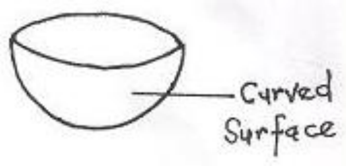


Volume of a sphere: $V = \frac{4}{3}\pi r^3$

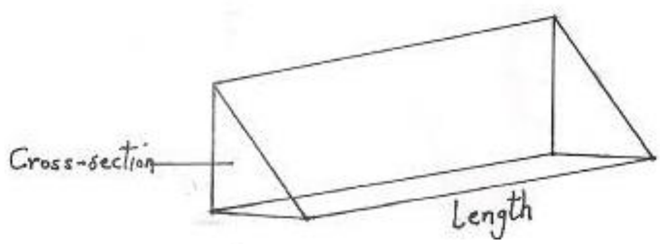


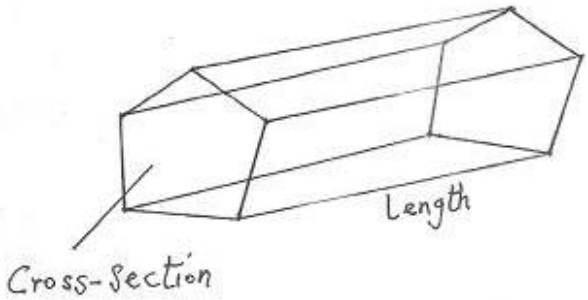
Surface Area of a sphere: $A = 4\pi r^2$

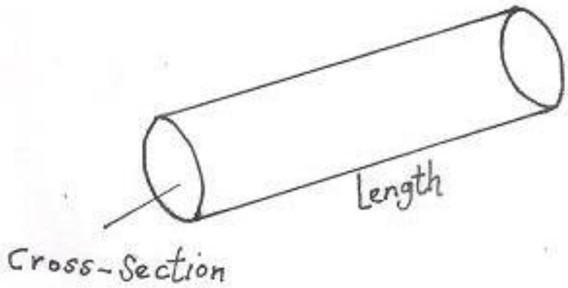
Volume of a hemisphere: $V = \frac{2}{3}\pi r^3$



Curved Surface Area of a hemisphere: CSA = $2\pi r^2$
Total Surface Area of a hemisphere: TSA = $3\pi r^2$
Volume of a prism: V = Area of cross-section x length





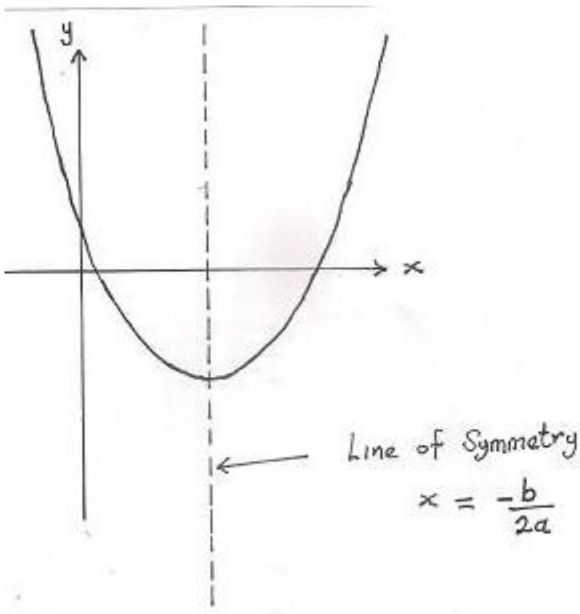


Algebra Formulas

For quadratic equation: $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Line of symmetry: $x = \frac{-b}{2a}$



Discriminant, D = $b^2 - 4ac$

If D > 0, the quadratic equation has two different real roots. If D = 0, it has same real roots. If D < 0, it has complex roots.

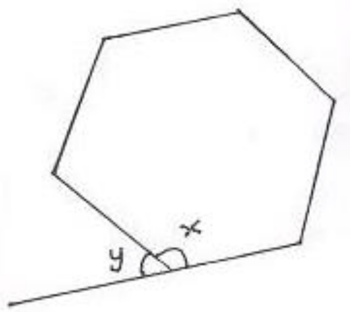
Polygons

Sum of interior angles of a polygon: Sum = $(n-2)180^0$ or Sum = $(2n - 4)90^0$

or Sum = $n\theta$ (For a regular polygon with each interior angle of θ)

Sum of exterior angles of a polygon: Sum = 360^0

Sum of adjacent interior and exterior angles of a polygon is 180^0.



i.e. $x + y = 180^0$

Polygons and their Names

No of Sides	Name of Polygon
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon
11	Hendecagon or Undecagon

12	Dodecagon
13	Tridecagon
14	Tetradecagon
15	Pentadecagon
16	Hexadecagon
17	Heptadecagon
18	Octadecagon
19	enneadecagon
20	Icosagon

Quadratic Equations

Quadratic equation whose roots are α and β is:

$x^2 - (\alpha+\beta)x + \alpha\beta = 0$ i.e.

x^2 – (sum of roots)x + product of roots = 0

$\alpha+\beta = \frac{-b}{a}$ $\alpha\beta = \frac{c}{a}$

Identities on α and β

$\alpha^2 + \beta^2 = (\alpha+\beta)^2 - 2\alpha\beta$

$\alpha^2 - \beta^2 = (\alpha+\beta)(\alpha-\beta)$

$\alpha - \beta = \sqrt{(\alpha+\beta)^2 - 4\alpha\beta}$

$\alpha^3 + \beta^3 = (\alpha+\beta)^3 - 3\alpha\beta(\alpha+\beta)$

$\alpha^3 - \beta^3 = (\alpha - \beta)^3 + 3\alpha\beta(\alpha-\beta)$

$\alpha^4 + \beta^4 = (\alpha+\beta)^4 + 2(\alpha\beta)^2 - 4\alpha\beta(\alpha+\beta)^2$

$\infty^4 - \beta^4 = (\alpha^2+\beta^2)(\alpha^2-\beta^2)$

Formulas on Logarithms

LogPQ = LogP + LogQ

$\text{Log}(^P/_Q) = \text{LogP} - \text{LogQ}$

$\text{Log}_b P^n = n\text{Log}_b P$

$\text{Log}_b b = 1$

Change of Base: $\text{Log}_b P = \frac{\text{Log}_c P}{\text{Log}_c b}$

Relationship between index form and log form

$\text{Log}_x P = n$ (log form) $x^n = P$ (Index form)

Statistics Formulas

Mean: $\bar{x} = \frac{\Sigma x}{n}$ or $\bar{x} = \frac{\Sigma fx}{\Sigma f}$ (For grouped data)

Median: Median = $\frac{(n + 1)^{th}}{2}$. If n is even, the median is the mean of the two middle numbers of the set.

For a grouped data set, Median(without using the graph) = $L + {}^c/_f\,({}^N/_2 - F)$ where:

L = Lower boundary of the median class,

c = class with,
f = frequency
$N = \Sigma f$;
F = cumulative frequency up to the group immediately preceding the median class.
If the total frequency (i.e. Σf) is not large (e.g. 50), then, N in the formula is replaced with N+1.

Mode: This is the value with the highest frequency.
For a grouped data set, Mode (without using the graph) = $L + \left\{\frac{l}{l + u}\right\}c$ where:

L = Lower boundary value of the modal class,
l = difference between the modal class frequency and the frequency of the class after the modal class (i.e. $f_m - f_a$) ;
c = class width .

Measures of Dispersion

Range: This is the difference between the biggest and the smallest value.

Mean Deviation: $M.D. = \frac{\Sigma/x - \bar{x}/}{n}$ (For ungrouped data)

$$M.D. = \frac{\Sigma f/x - \bar{x}/}{\Sigma f}$$ (For grouped data)

Quartiles i.e. Q_1 and Q_3 (without using the plotted graph)

$Q_1 = L + {}^{c}/_{f}\,({}^{N}/_{4} - F)$ where:
L = Lower boundary,
c = class with,
f = frequency of the class,
$N = \Sigma f$;
F = cumulative frequency up to the group immediately preceding the class.

$Q_3 = L + {}^{c}/_{f}\,({}^{3N}/_{4} - F)$

A Decile: ${}^{n}/_{10}$ e.g. third decile is at the position ${}^{3n}/_{10}$

A Percetile: ${}^{n}/_{100}$ e.g. twenty-third percentile is at $\frac{23n}{100}$, (n = total frequency)

Interquartile Range: $Q_3 - Q_1$

Semi-Interquartile Range: $\frac{Q_3 - Q_1}{2}$

Variance: $\text{Variance} = \frac{\Sigma fd^2}{\Sigma f}$ $(d = x - \bar{x})$

Standard Deviation (S.D.)

$S.D. = \sqrt{\frac{\Sigma d^2}{n}}$ (For ungrouped data)

$$S.D. = \sqrt{\frac{\Sigma fd^2}{\Sigma f}}$$ (For grouped data)

Standard Derivatives in Differential Calculus

	y or $f(x)$	$\frac{dy}{dx}$
1	x^n	nx^{n-1}
2	constant c (e.g 5)	0
3	sinx	cosx
4	cosx	-sinx
5	tanx	sec^2x
6	secx	secxtanx
7	cosecx	-cosecxcotx
8	cotx	$-cosec^2x$
9	e^x	e^x
10	$log_a x$	$\frac{1}{x} log_a e$
11	lnx	$\frac{1}{x}$
12	a^x	$a^x lna$

Standard Integrals in Integral Calculus

	y or $f(x)$	$\int ydx$ or $\int f(x)dx$
1	x^n	$\frac{x^{n+1}}{n+1} + c$ (provided $n \neq 1$)
2	$\frac{1}{x}$	lnx + c
3	e^x	$e^x + c$
4	cosx	sinx + c
5	sinx	-cosx + c
6	sec^2x	tanx + c
7	secxtanx	secx + c
8	cosecxcotx	-cosecx + c
9	$cosec^2x$	-cotx + c
10	a^x	$\frac{a^x}{lna} + c$
11	$\frac{f'(x)}{f(x)}$	$\ln f(x) + c$
12	$f(x)f'(x)$	$\frac{[f(x)]^2}{2} + c$

Formulas in Coordinate Geometry

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

Midpoint of a line connecting (x_1, y_1) and (x_2, y_2) = ($\frac{x1+x2}{2}$, $\frac{y1+y2}{2}$)

Gradient of a line = tanθ where θ is the angle the line makes with the x-axis.

Gradient of a line joining (x_1, y_1) and (x_2, y_2) = $\frac{y_2-y_1}{x_2-x_1}$

Equation of a Straight Line

1. Gradient and y-intercept form is: $y = mx + c$ where m is the gradient and c is the y-intercept.
2. Gradient and One Point Form: $y-y_1 = m(x-x_1)$
3. Two Points Form: $\frac{y-y1}{x-x1} = \frac{y2-y1}{x2-x1}$
4. Perpendicular Distance from Origin Form: $x\cos\theta + y\sin\theta = L$ where θ is the angle the line makes with the positive x-axis and L is the length.
5. x- and y- intercepts Form: $\frac{x}{d} + \frac{y}{c} = 1$ where d is the x-intercept and c is the y-intercept.
6. General Equation of a Straight Line: $ax + by + c = 0$.

Angle between Two Lines

Acute angle θ between two lines of gradients m_1 and m_2 is given by:

$$\tan\theta = \left| \frac{m1-m2}{1+m1m2} \right|$$

For parallel lines, $m_1 = m_2$ (i.e. equal gradient)

For perpendicular lines, $m_1m_2 = -1$

On Circles

The equation of a circle with centre (0,0) and radius r is: $x^2 + y^2 = r^2$

The equation of a circle with centre (a,b) and radius r is: $(x-a)^2 + (y-b)^2 = r^2$

The general equation of a circle is: $x^2+y^2+2gx=2fy+c = 0$ where $g = -a$, $f = -b$, and $c = a^2+b^2-r^2$

Trigonometry

$\sin\theta = \cos(90-\theta)$, $\cos^2\theta + \sin^2\theta = 1$

$\sec\theta = 1/\cos\theta$, $\text{cosec}\theta = 1/\sin\theta$, $\cot\theta = 1/\tan\theta$

Also, $\cot\theta = \frac{\cos\theta}{\sin\theta}$, $\tan\theta = \frac{\sin\theta}{\cos\theta}$,

$1+\cot^2\theta = \text{cosec}^2\theta$, $1+\tan^2\theta = \sec^2\theta$

Double Angles:

$\sin 2A = 2\sin A\cos A$, $\cos 2A = \cos^2 A - \sin^2 A$

$= 2\cos^2 A - 1$

$= 1 - 2\sin^2 A$

$$\text{Tan}2A = \frac{2\tan A}{1 - \tan^2 A}$$

Compound Angles

$\sin(A+B) = \text{SinACosB} + \text{CosASinB}$

$\sin(A-B) = \text{SinACosB} - \text{CosASinB}$

$\cos(A+B) = \text{CosACosB} - \text{SinASinB}$

$\cos(A-B) = \text{CosACosB} + \text{SinASinB}$

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\text{Tan}(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

Sin Rule: $\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$

Cosine Rule: $a^2 = b^2 + c^2 - 2bc\text{Cos } A$

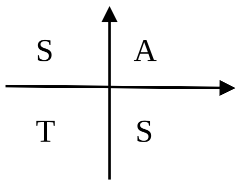
Cosine Rule is applicable under the following conditions:

1. when two sides and included angle are given
2. when all the three sides are given.

On Surds

$\sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$, $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$

Trigonometric Ratio in the Four Quadrants



A: All positive in that quadrant

S: only Sine positive in that quadrant

T: only Tan positive in that quadrant

C: only Cosine positive in that quadrant

Latitude and Longitude

Distance along Great Circles = $\frac{\theta}{360} \times 2\pi R$ where R is the radius of the Earth.

Distance along parallels of latitude (i.e small circles) = $\frac{\theta}{360} \times 2\pi r$ where r is the radius of that small circle and r is given as: $r = R\cos\alpha$ where α is the latitude of the small circle.

Bearing and Distance

In interpretation of questions on Bearing, make sure you draw four cardinal points at every given point. This is very important. This would help in determining some angles like alternate angles, corresponding angles, vertically opposite angles, etc.

Conversion of Sector to Cone and Vice Versa

Take note of the following here:

- The area of the sector is equal to the curved surface area of the cone.
- The radius of the sector becomes the slant height of the cone.
- The length of the arc of the sector becomes the circumference of the cirle at the base of the cone.

SOLUTIONS TO WASSCE JUNE 2016 OBJECTIVE QUESTIONS

1. If $23_x + 101_x = 130_x$, find the value of x. A. 7 B. 6 C. 5 D. 4

Solution:

To find the value x here, just convert the numbers to base ten and solve for x. So,

$23_x + 101_x = 130_x \longrightarrow$

$(2 \times x^1) + (3 \times x^0) + (1 \times x^2) + (0 \times x^1) + (1 \times x^0) = (1 \times x^2) + (3 \times x^1) + (0 \times x^0) \longrightarrow$

$2x + 3 + x^2 + 0 + 1 = x^2 + 3x + 0$, $\longrightarrow$

$x^2 + 2x + 4 = x^2 + 3x \longrightarrow 4 = 3x - 2x$, :. x = 4 Ans: D

Now, try this:

If $22_y + 102_y = 201_y$, find the value of y. Ans: y = 3

2. Simplify: $(^3/_4 - ^2/_3) \times 1^1/_5$ A. $^1/_{60}$ B. $^5/_{72}$ C. $^1/_{10}$ D. $1^7/_{10}$

Solution:

$(^3/_4 - ^2/_3) \times 1^1/_5 = (^3/_4 - ^2/_3) \times ^6/_5 = (\frac{9-8}{12}) \times ^6/_5 = ^1/_{12} \times ^6/_5 = ^1/_2 \times ^1/_5 = ^1/_{10}$ Ans: C

Now try this:

Simplify: $(^4/_5 - ^3/_4) \times 3^1/_3$ Ans $= ^1/_6$

3. Simplify: $(\frac{10\sqrt{3}}{\sqrt{5}} - \sqrt{15})^2$ A. 75 B. 15 C. 8.66 D. 3.87

Solution:

$(\frac{10\sqrt{3}}{\sqrt{5}} - \sqrt{15})^2 = (\frac{10\sqrt{3}}{\sqrt{5}} - \sqrt{15})(\frac{10\sqrt{3}}{\sqrt{5}} - \sqrt{15}) =$

$\frac{10\sqrt{3}}{\sqrt{5}}(\frac{10\sqrt{3}}{\sqrt{5}} - \sqrt{15}) - \sqrt{15}(\frac{10\sqrt{3}}{\sqrt{5}} - \sqrt{15}) = \frac{100(3)}{(5)} - \frac{10\sqrt{45}}{\sqrt{5}} - \frac{10\sqrt{45}}{\sqrt{5}} + 15 =$

$60 - 10(3) - 10(3) + 15 = 60 - 30 - 30 + 15 = 60 - 60 + 15 = 15$ Ans: B

Now try this:

Simplify: $(\frac{10\sqrt{3}}{\sqrt{5}} + \sqrt{15})^2$ Ans = 135

4. The distance, d, through which a stone falls from rest varies directly as the square of the time t, taken. If the stone falls 45cm in 3 seconds, how far will it fall in 6 seconds?

A. 90cm B.135cm C. 180cm D. 225cm

Solution:

This is question on Direct Variation. From the 1st sentence provided, we have:

$d \propto t^2 \longrightarrow d = kt^2$

If the stone falls 45cm in 3 seconds, we have:

$45 = k(3)^2 \longrightarrow 45 = 9k$:. $k = ^{45}/_9$:.k =5

Hence, the relationship between d and t is: $d = 5t^2$

Now, in 6 seconds, $d = 5(6)^2 = 5 \times 36 = 180$cm Ans: C

Now, try this:

From the question, what time would the stone spend to fall a distance of 125cm? Ans = 5 seconds

5. Which of the following is a valid conclusion from the premise:

"Nigerian footballers are good footballers" ?

A. Joseph plays football in Nigeria, therefore, he is a good footballer.

B. Joseph is a good footballer, therefore, he is a Nigerian footballer.

C. Joseph is a Nigerian footballer, therefore, he is a good footballer.

D. Joseph plays good football, therefore, he is a Nigerian footballer.

Solution:

From the given premise, it implies that if you are a Nigerian footballer, then, you are a good footballer. So the correct option here is C.

Now try this:

From the following premises, what valid conclusion can you deduce about Obasanjo?

Obasanjo is a farmer.

All farmers are good leaders.

Therefore,………………………

Ans: Obasanjo is a good leader.

6. On a map, 1cm represents 5km. Find the area on the map that represent $100km^2$.

A. $2cm^2$ B. $4cm^2$ C. $8cm^2$ D. $16cm^2$

Solution:

On the map, 5km ≡ 1cm (Given)

We need to consider km^2 to be able to get the area. So, squaring both sides of 5km ≡ 1cm gives:

$(5km)^2 \equiv (1cm)^2 \longrightarrow 25km^2 \equiv 1cm^2 \longrightarrow 1km^2 \equiv \frac{1}{25}cm^2$

:. $100km^2 \equiv {}^{1}/_{25} \times {}^{100}/_{1} = 4cm^2$ Ans: B

Now, try this:

From the question, find the area on map that represents $250km^2$. Ans $=10cm^2$

7. Simply: $\frac{3^{n-1} \times 27^{n+1}}{81^n}$

A. 3^{2n} B. 9 C. 3^n D. 3^{n+1}

Solution:

$$\frac{3^{n-1} \times 27^{n+1}}{81^n} = \frac{3^{n-1} \times 3^{3(n+1)}}{3^{4n}} = \frac{3^{(n-1)+3^{(3n+3)}}}{3^{4n}} =$$

$$\frac{3^{(n-1)+(3n-1)}}{3^{4n}} = \frac{3^{n-1+3n+3}}{3^{4n}} = \frac{3^{3n+n+3-1}}{3^{4n}} = \frac{3^{4n+2}}{3^{4n}} = \frac{3^{4n} \times 3^2}{3^{4n}} = 3^2 = 9 \quad \text{Ans: B}$$

Now try this.

Simplify: $\frac{2^{n-1} \times 32^{n+1}}{64^n}$ Ans =16

8. What sum of money will amount to D 10400 in 5 years at 6% interest?

A. D 8000 B. D10000 C. D12000 D. D16000

Solution:

This is a question on Simple Interest. From the question, time, T = 5years, Rate R=6%.

Remember, Amount(A) = Principal(P) + Interest(I)

i.e. A = P + I . So, P + I = 10400 ……………(i) From $I = \frac{PRT}{100}$, we have:

$I = \frac{PX6X5}{100}$, $\longrightarrow$ 100I = 30P :. $I = \frac{30P}{100}$ ……………(ii)

Putting (ii) into (i) gives:

$\frac{P}{1} + \frac{30P}{100} = 10400$, $\frac{100P+30P}{100} = \frac{10400}{1}$, $\longrightarrow$

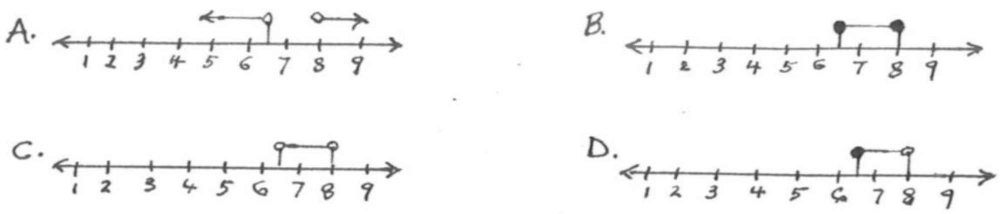
130P = 1040000 :. $P = \frac{1040000}{130}$:. P = 8000 Ans: A

Now, try this:

From the question, determine the interest produced in 5 years at 6% interest. Ans = D 2400

9. Which of the following number lines illustrates solution of the inequality

$4 \leq \frac{1}{3}(2x-1) < 5$?



Solution:

Consider the first two expressions first and solve for x: So,

$4 \leq \frac{1}{3}(2x-1)$. Multiplying through by 3 gives:

$12 \leq 2x - 1$, $12+1 \leq 2x$, $13 \leq 2x$, $\longrightarrow$ $2x \geq 13$:. $x \geq {}^{13}/_{2}$ $\longrightarrow$

:. $x \geq 6.5$ ………… (i)

Now, consider the last two expressions and also solve for x: $\frac{1}{3}(2x-1) < 5$

$2x - 1 < 15$, $2x < 15+1$, $2x < 16$:. $x < {}^{16}/_{2}$:. $x < 8$ …………..(ii)

Now, merging (i) and (ii) together produces $6.5 \leq x < 8$. Ans: D

Now, try this:

Show on a number line the solution of the inequality $11 < \frac{1}{2}(3x+1) \leq 17$.

Ans: $7 < x \leq 11$

10. The roots of a quadratic equation are ${}^{4}/_{3}$ and ${}^{-3}/_{7}$. Find the equation?

A. $21x^2 - 19x - 12 = 0$ B. $21x^2 + 37x - 12 = 0$ C. $21x^2 - x + 12 = 0$

D. $21x^2 + 7x - 4 = 0$

Solution:

If the roots the quadratic equations are $^4/_3$ and $^{-3}/_7$, then, $x = {}^4/_3$ or $x = {}^{-3}/_7$ ⟶

$x - {}^4/_3 = 0$ or $x + {}^3/_7 = 0$ ⟶ $(x - {}^4/_3)(x + {}^3/_7) = 0$ ⟶

$x^2 + \frac{3x}{7} - \frac{4x}{3} - \frac{4}{7} = 0$ Multiplying through by 21 gives:

$21x^2 + 9x - 28x - 12 = 0$, ⟶ $21x^2 - 19x - 12 = 0$ Ans: A

You can also find the equation using the formula: x^2 - (sum of roots)x + (product of roots) = 0

Now, try this:

Find the quadratic equation whose roots are: 5 and 2 . Ans: $x^2 - 7x + 10 = 0$

11. Find the values of y for which the expression $\frac{y2-9y+18}{y2+4y-21}$ is undefined.

A. 6, -7 B. 3, -6 C. 3, -7 D. -3, -7

Solution:

If any expression is undefined, that means its denominator is equal to zero (0).

So, $y^2 + 4y - 21 = 0$, ⟶ $y^2 + 7y - 3y - 21 = 0$,

$y(y+7) - 3(y+7) = 0$, $(y+7)(y-3)=0$, :.y+7 = 0 or y-3 = 0

:. y = -7 or y = 3 Ans: C

Now, try this:

Find the values of x for which the expression $\frac{x2-9y+18}{x2+2x-15}$ is undefined.

Ans: x = 3 or x = -5

12. Given that $2x + y = 7$ and $3x - 2y = 3$, by how much is 7x greater than 10?

A. 1 B. 3 C. 7 D.17

Solution:

We are given simultaneous equations here. So,

$2x + y = 7$……………. (i)

$3x - 2y = 3$……………. (ii)

Let's use Elimination method to solve the equations:

Multiplying equ(i) through by 2 gives:

$4x + 2y = 14$ …………..(i)

$\underline{3x - 2y = 3}$ ……………(ii)

$7x = 17$:. $x = {}^{17}/_7$

Hence, $7x = 7({}^{17}/_7) = 17$. So, $7x - 10 = 17 - 10 = 7$ Ans: C

Now, try this:

From the question, by how much is 7y greater than 10? Ans = 5

13. Simplify: $\frac{2}{1-x} - \frac{1}{x}$

A. $\frac{(x+1)}{x(1-x)}$ B. $\frac{3x-1}{x(1-x)}$ C. $\frac{3x+1}{x(1-x)}$ D. $\frac{x-1}{x(1-x)}$

Solution:

$\frac{2}{1-x} - \frac{1}{x} = \frac{2x-1(1-x)}{x(1-x)} = \frac{2x-1+x}{x(1-x)} = \frac{2x+x-1}{x(1-x)} = \frac{3x-1}{x(1-x)}$ Ans: B

Now, try this:

Simplify: $\frac{2}{1-x} + \frac{1}{x}$ Ans. = $\frac{x+1}{x(1-x)}$

14. Make s the subject of the relation: $p = s + \frac{sm2}{nr}$

A. $s = \frac{mrp}{nr+m2}$ B. $s = \frac{nr+m2}{mrp}$ C. $s = \frac{nrp}{mr+m2}$ D. $s = \frac{nrp}{nr+m2}$

Solution:

$p = s + \frac{sm2}{nr} \longrightarrow p = \frac{nrs+sm2}{nr} \longrightarrow$ nrs + sm^2 = npr , s(nr + m^2) = npr ,

:. $s = \frac{nrp}{nr+m2}$ Ans: D

Now, try this:

From the question, make m the subject of the formula. Ans: $m = \sqrt{\frac{npr-nrs}{s}}$

15. Factorize: $(2x + 3y)^2 - (x - 4y)^2$

A. (3x-y)(x+7y) B. (3x+y)(2x-7y) C. (3x+y)(x-7y) D. (3x-y)(2x+7y)

Solution:

Here, we need to apply "Difference of Two Squares" principle. Can you still remember the principle?

i.e $A^2 - B^2 = (A + B)(A - B)$

So, $(2x+3y)^2 - (x-4y)^2$ = [(2x+3y)+((x-4y)] [(2x+3y)-(x-4y)]

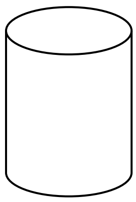
= [2x+3y+x-4y] [(2x+3y-x+4y] = (3x-y)(x+7y) Ans: A

Now, try this:

Factorize completely: $(5a+4b)^2 - (2a-5b)^2$. Ans =3(7a-b)(a+3b)

16. The curved surface area of a cylinder, 5cm high is 110cm^2. Find the radius of its base. (Take $\pi = {}^{22}/_{7}$). A. 2.6cm B. 3.5cm C. 3.6cm D. 7cm

Solution:



Curved surface area = 2πrh

So, $110 = 2(\frac{22}{7})(r)(5) \longrightarrow$ 220r = 110 x 7 :. $r = \frac{770}{220}$ = 3.5cm Ans: B

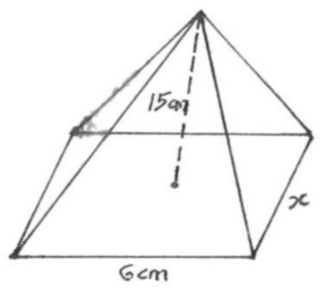
Now, try this:

The curved surface area of a cone with slant height 14cm is 154cm^2. Find the radius of its base. Ans = 3.5cm

17. The volume of a pyramid with height 15cm is 90cm^3. If its base is a rectangle with dimensions x cm and by 6cm, find the value of x. A. 3 B. 5 C.6 D. 8

Solution:

From the illustration, we have the following:



Volume of a pyramid = $\frac{1}{3}$ x base area x height . So, $90 = \frac{1}{3}$ x 6x x 15

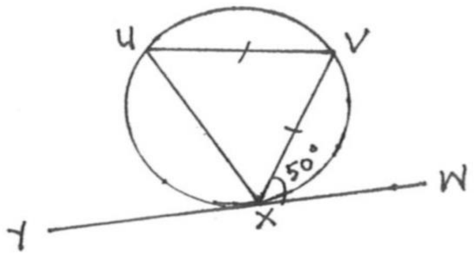
(Note that base area = L x B = 6 x x = 6x)

So, 90 = 6x x 5, 30x = 90 :. x = $\frac{90}{30}$, :. x = 3 Ans: A

Now, try this:

The volume of a pyramid with height 6cm is $72cm^3$. If its base is a square with dimensions x cm by x cm, find the value of x. Ans: x = 6cm

18.



In the diagram, $Y\overline{W}$ is a tangent to the circle at X, |UV|=|VX| and <VXW = 50^0. Find the value of <UXY. A. 70^0 B. 80^0 C. 105^0 D. 110^0

Solution:

<VUX = 50^0 (Alternate segment angle)

<VXU = 50^0 (Base angles of an isosceles triangles are equal)

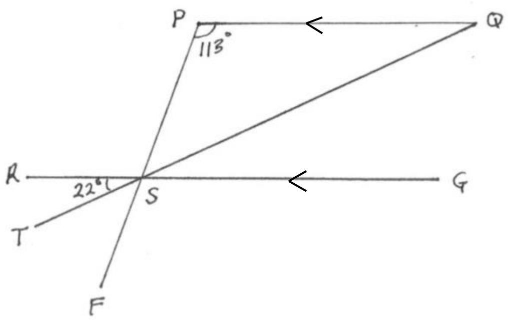
<UVX = 80^0 (Sum of angles of a triangles is 180^0)

:. <UXY = 80^0 (Alternate segment angle). Ans: B

Now, try this:

From the question, determine < VXY. Ans = 130^0

19.



In the diagram, $\overline{PF}$, $\overline{QT}$, $\overline{RG}$ intersect at S and PQ // RG. If <SPG = 113^0 and <RST = 22^0, find <PSQ. A. 22^0 B. 45^0 C. 67^0 D. 89^0

Solution:

<QSG = 22^0 (Vertical opposite angle)

Remember: <SPQ + <PSG=180^0 (Sum of adjacent angles of a parallelogram is 180^O). So,

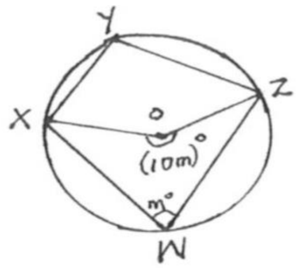
113 + <PSQ + 22 =180^0

<PSQ + 135 = 180, <PSQ = 180 – 135 , :. <PSQ = 45^0 Ans: B

Now, try this:

From the question, determine <QSF. Ans = 135^0

20.



In the diagram, O is the centre of the circle, <XOZ = $(10m)^0$ and <XWZ = m^0. Calculate the value of m. A. 30 B. 36 C. 40 D. 72

Solution:

<XYZ = $(5m)^0$ (Angle at the centre = 2 x angle at the circumference i.e $\frac{10m}{2}$ = 5m)

Remember, <XYZ + <XWZ = 180^0 (Opposite angles of a cyclic quadrilateral are supplementary i.e. 180^0 when added). So, 5m + m = 180^0 , 6m = 180,

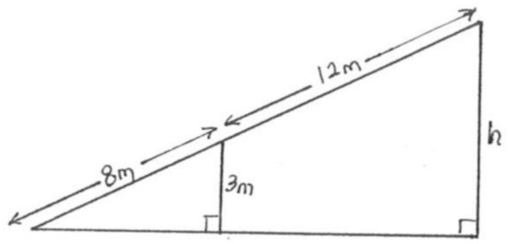
:. m = 30 Ans: A

21. Kweku walked 8m up a slope and was 3m above the ground. If he walks 12m further up the slope, how far above the ground will he be?

A. 4.5m B. 6m C. 7.5m D. 9m

Solution:

From the illustration, we have:



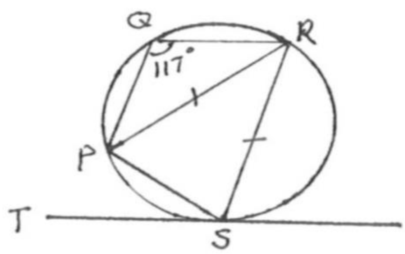
This is an applied question on Similar Triangles. Remember, in similar triangles, ratios of similar sides are equal. So, for the smaller triangle in the diagram, the hypotenuse side is 8m in length. For the bigger triangle, its hypotenuse side has the length 20m (i.e. 8+12). So,

$\frac{8}{20} = \frac{3}{h}$ (Let kweku's final distance above the ground be h).

⟶ 8h = 60 :.h = $\frac{60}{8}$ = 7.5m Ans: C

Now, try this:
From the question, determine kweku's horizontal distance from his starting point, correct to 1 decimal place. Ans: = 18.5m

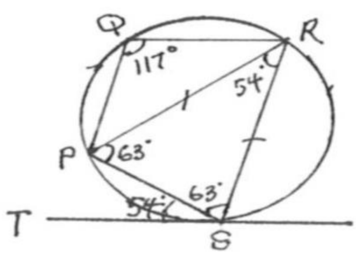
22.



In the diagram, TS is a tangent to the circle at S. /PR/=/RS/ and <PQR =177^0. Calculate < PST. A. 54^0 B. 44^0 C. 34^0 D. 27^0

Solution:

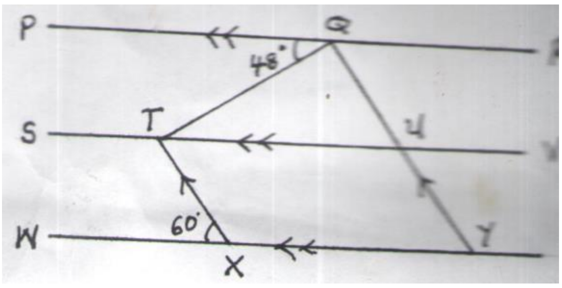
Consider the following analysis in the diagram below:



<PSR = 63^0 (180^0 – 117^0 = 63^0, <PQR and <PSR are supplementary)
<SPR = 63^0 (Base angles of an isosceles triangle are the same)
<PRS = 54^0 (Sum of angles of triangle is 180^0)
:. <PST = 54^0 (Alternate segment angle).

Now try this:
From the question, determine <QPR + <QRP. Ans. = 63^0

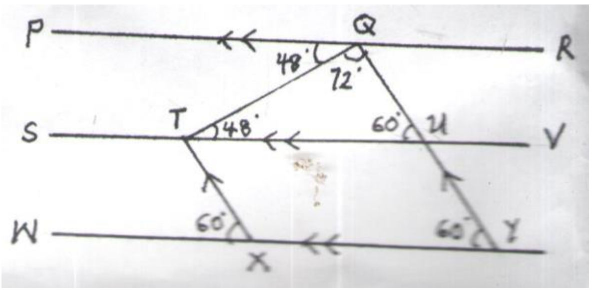
23.



In the diagram, PR// SV// WY//, TX//QY, <PQT = 48^0 and <TXW = 60^0. Find < TQU. A. 120^0 B. 108^0 C. 72^0 D. 60^0

Solution:

Consider the analysis in the diagram below:



<QTU = 48^0 (Alternate angle), <XYU = 60^0 (Corresponding angle) ,

<QUT = 60^0 (Corresponding angle) .

Now, <QTU + <QUT + <TQU = 180^0 (Sum of angles of a triangle is 180^o).

So, 48 + 60 + <TQU = 180^0

<TQU + 108 = 180^0 :. <TQU = 180 – 108 = 72^0 Ans: C

Now, try this:

From the question, determine < QTX. Ans. = 108^0

A straight line passes though the points to answer P(1,2) and Q(5,8). Use this formulation to answer questions 24 and 25.

24. Calculate the gradient of the line PQ.

A. $^3/_5$ B. $^2/_3$ C. $^3/_2$ D. $^5/_3$

Solution:

Remember, gradient(m) of the line passing through (x_1,y_1) and (x_2,y_2) is :

$$m = \frac{y2-y1}{x2-x1}\ .$$

So, the gradient of the line passing through P(1,2) and Q(5,8) = $\frac{8-2}{5-1} = \frac{6}{4} = \frac{3}{2}$ Ans: C

25. Calculate the length PQ. A. 4√11 B. 4√10 C. 2√17 D. 2√13

Solution:

Remember, the length of a line passing through (x_1,y_1) and (x_2,y_2) is:

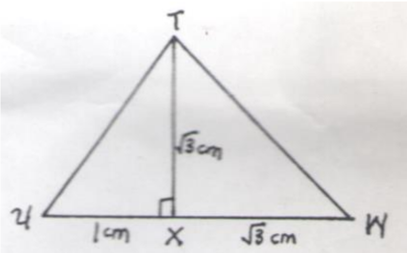
$d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

So, the length of PQ = $\sqrt{(5-1)^2 + (8-2)^2}$ = $\sqrt{4^2 + 6^2}$ = $\sqrt{16+36}$ = $\sqrt{52}$ = $\sqrt{4 \text{ x } 13}$ = $\sqrt{14}$ x $\sqrt{13}$ = $2\sqrt{13}$ Ans: D

Now, try this:

Determine the gradient of a line passing through A(2,1) and B(3,5). Ans = 4

26.



In the diagram, TX is perpendicular to UW, /UX/ = 1cm and /TX/ = √3cm.

Find <UTW. A. 135^0 B. 105^0 C. 75^0 D. 60^0

<u>Solution:</u>

In triangle XTW, let <T be θ. So, $\tan\theta = \frac{\sqrt{3}}{\sqrt{3}} = 1$ $:. \theta = \tan^{-1}(1) = 45^0$

Also, in triangle XTU, let <T be α. So, $\tan\alpha = \frac{1}{\sqrt{3}} = 0.5774$:. $\alpha = \tan^{-1}(0.5774)$

:. $\alpha = 30^0$

Note that <UTW = <XTU + <XTW

:. < UTW = 30 + 45 = 75^0 Ans: C

Now, try this:

From the question, determine <TUX. Ans = 60^0

27. If $\cos\theta = x$ and $\sin 60^0 = x + 0.5$, $0^0 \leq \theta \leq 90^0$, find, correct to the nearest degree, the value of θ. A. 66^0 B. 67^0 C. 68^0 D. 69^0

<u>Solution:</u>

$\sin 60^0 = x + 0.5$, $x = \cos\theta$ (Given). ⟶

$\sin 60^0 = \cos\theta + 0.5$ ⟶ $0.8660 = \cos\theta + 0.5$ ($\sin 60^0 = 0.8660$)

$\cos\theta = 0.8660 - 0.5 = 0.3660$

:. $\theta = \cos^{-1}(0.3660) = 68.53 = 69^0$ Ans: D

Now, try this:

If $\cos\theta = x$ and $\tan 30^0 = x + 0.5$, $0^0 \leq \theta \leq 90^0$, find, correct to the nearest degree, the value of θ. Ans. = 86^0

Age (Years)	13	14	15	16	17
Frequency	10	24	8	5	3

The table shows the ages of students in a club. Use it to answer questions 28 and 29.

28. How many students are in the club?

A. 50 B. 55 C. 60 D. 65

Solution:

From the table, we have the following analysis:

Number of students who are 13 years old = 10

Number of students who are 14 years old = 24

Number of students who are 15 years old = 8

Number of students who are 16 years old = 5

Number of students who are 17 years old = 3

Total number of students = **50**

:. Number of students in the club = 50 Ans. A

29. Find the media age. A. 13 B. 14 C. 15 D. 16

Solution:

Total number of students in the club = 50

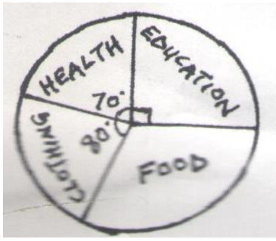
Median of 50 is the average of 25 and 26 items. Fortunately here, both 25 and 26 items are age 14. (From the table)

:. The median = 14 Ans: B

Now, try this:

From the question, what is the modal age? Ans. = 14 years

30.



The figure is a pie chart which represents the expenditure of a family in a year. If the total income of the family was Le 10,800,000, how much was spent on food?

A. Le 2,250,000 B. Le 2,700,000 C. Le 3,600,000 D. Le 4,500,000

Solution:

Let the sectoral angle of FOOD be θ. So, $\theta + 90 + 70 + 80 = 360^0$ (Sum of all sectoral angles = 360^0). $\theta + 240 = 360^0$:. $\theta = 360 - 240 = 120^0$

Hence, amount spent on FOOD = $\frac{120}{360} \times \frac{10,800,000}{1}$ = 3,600,000 Ans: C

Now, try this:

From the question, how much was spent on EDUCATION? Ans. = Le 2,700,000

31. A fair die is thrown two times. What is the probability that the sum of the scores is at least 10?

A. $\frac{5}{36}$ B. $\frac{1}{6}$ C. $\frac{5}{18}$ D. $\frac{2}{3}$

Solution:

When a die is thrown two times, we have the following outcomes;

1st Die

	1	2	3	4	5	6	2nd die
1	1,1	1,2	1,3	1,4	1,5	1,6	
2	2,1	2,2	2,3	2,4	2,5	2,6	
3	3,1	3,2	3,3	3,4	3,5	3,6	
4	4,1	4,2	4,3	4,4	4,5	4,6	
5	5,1	5,2	5,3	5,4	5,5	5,6	
6	6,1	6,2	6,3	6,4	6,5	6,6	

If we add the two scores together, we would have the following outcomes.

1st Die

	1	2	3	4	5	6	2nd die
1	2	3	4	5	6	7	
2	3	4	5	6	7	8	
3	4	5	6	7	8	9	
4	5	6	7	8	9	10	
5	6	7	8	9	10	11	
6	7	8	9	10	11	12	

Number of sums that are 10 and above = 6 . :. Pr(Sum of scores is at least 10) = $^6/_{36}$ = $^1/_6$ Ans. B

Note that total possible outcomes is 36. (From the table).

Now, try this:

From the question, what is the probability that the sum of the scores is at most 5? Ans. = $^5/_{18}$

32. The marks of eight students in a test are: 10, 4, 5, 3, 14, 13, and 7. Find the Range.

A. 16 B. 14 C.13 D. 11

Solution:

Range is the difference between the highest and lowest marks. So,

Highest mark = 16 Lowest mark = 3

:. Range = 16 – 3 = 13 Ans: C

Now, try this:

Calculate the mean of the given data set. Ans. = 9

33. If $\log_2(3x – 1) = 5$, find x.

A. 2 B. 3.67 C. 8.67 D. 11

Solution:

Note that $\log_2(3x – 1) = 5$ is in Log form. So, in Index form, it would be $3x – 1 = 2^5$

⟶ $3x – 1 = 32$, $3x = 32 + 1$, $3x = 33$,

:. $x = {}^{33}/_{3}$:. x = 11 Ans. D

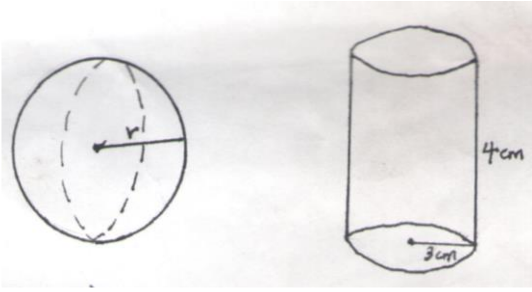
Now, try this:

If $\log_5(2x - 1) = 2$, find x. Ans: x = 13

34. A sphere of radius r cm has the same volume as a cylinder of radius 3cm and height 4cm. Find the value of r. A. $^2/_3$ B. 2 C. 3 D. 6

Solution:

From the illustration, we have the following:



Volume of a sphere, $V_s = \frac{4}{3}\pi r^3$, Volume of a cylinder, $V_c = \pi r^2 h = \pi \times 3^2 \times 4 = \pi \times 9 \times 4$

$= 36\pi$. Remember we are told $V_s = V_c$. So,

$\frac{4}{3}\pi r^3 = 36\pi \longrightarrow \frac{4}{3}r^3 = 36 \longrightarrow 4r^3 = 36 \times 3$

$r^3 = \frac{36x3}{4}$, $r^3 = 27$, :. $r = \sqrt{27}$:. r = 3 Ans: C

Now, try this:

From the question, if the volume of the sphere is one-third of the volume of the cylinder, find the radius of the sphere, correct to 1 decimal place. Ans = 2.1cm

35. Express 1975 correct to 2 significant figures.

A. 20 B 1900 C. 1980 D. 2000

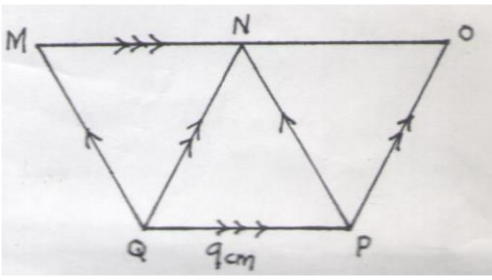
Solution:

The correct option here is 2000. Ans: D

Now, try this:

Express 24.975 correct to 3 significant figures. Ans = 25.0

36.

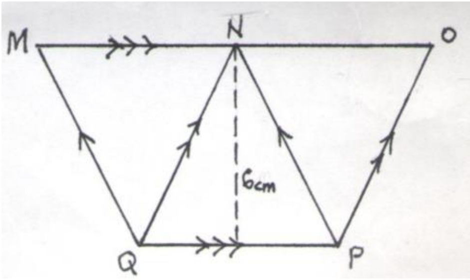


In the diagram, MOPQ is a trapezium with QP// MO, MQ//NP, NQ//OP, /OP/ = 9cm and the height of Δ QNP = 6cm. Calculate the area of the trapezium.

A. $96cm^2$ B. $90cm^2$ C. $81cm^2$ D. $27cm^2$

Solution:

Consider the analysis in the diagram below:



/MN/ = 9cm (Opposite sides of a parallelogram are equal)

/NO/ = 9cm (Opposite sides of a parallelogram are equal)

:. /MO/ = 9 + 9 = 18cm

Height h of the trapezium = 6cm (Given).

Hence, area of trapezium = $\frac{1}{2}$ (sum of parallel sides) x height = $\frac{1}{2}$ (9 + 18) x 6 =

$\frac{1}{2}$(27)(6) = 81cm^2 Ans: C

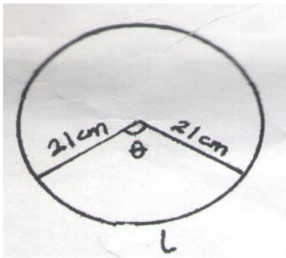
Now, try this:.

From the question, calculate the area of ΔMNQ. Ans. = 27cm^2

37. The perimeter of a sector of a circle of radius 21cm is 64cm. Find the angle of the sector. (Take π = $^{22}/_{7}$). A. 70^0 B. 60^0 C. 55^0 D. 42^0

Solution:

From the illustration, we have:



Perimeter of a sector = length of the arc + 2radii i.e P = L + 2r . Hence:

64 = L + 2(21) ⟶ 64 = L + 42 :. L = 64 – 42 = 22cm

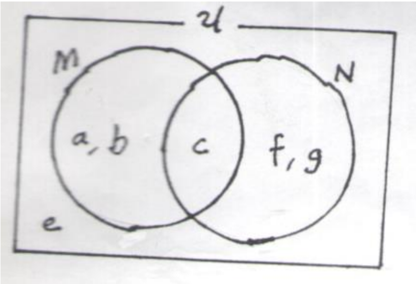
Remember, length (L) an arc = $\frac{\theta}{360}$ x 2πr ⟶

22 = $\frac{\theta}{360}$ x 2 x $\frac{22}{7}$ x 21 ⟶ 6θ = 360 :. θ = $\frac{360}{6}$:. θ = 60^0 Ans: B

Now, try this

From the question, calculate the area of the major sector of the circle. Ans = 1155cm^2

38.



Determine $M^c \cap N$ from the Venn diagram.

A. {f, g} B. {e} C. {c, f, g} D. {e, f, g}

Solution:

M^c = {f, g, e}, N = {c, f, g}

:. $M^c \cap N$ = {f, g} Ans. A

Now, try this:

From the question, determine $M \cup N^c$. Ans. = {a, b, c, e}

39. If 20(mod 9) is equivalent to y(mod 6), find y.

A. 1 B. 2 C. 3 D. 4

Solution:

20(mod 9) = 9 + 9 + 2 = 2(mod 9) (2 is the remainder)

y(mod 6) = 6 + y = y(mod 6) (y is the remainder)

:. y = 2 Ans: B

Remember, in modular arithmetic, we are only concerned with the remainder after removing the mod or multiple of mod from a given number.

Now, try this:

If 20(mod 7) is equivalent to x(mod 5), find x. Ans: x = 6

40. Simplify: $\frac{(p - r)^2 - r^2}{2p^2 - 4pr}$

A. $^1/_2$ B. p – 2r C. $\frac{1}{p-2r}$ D. $\frac{2p}{p-2r}$

Solution:

$$\frac{(p - r)^2 - r^2}{2p^2 - 4pr} = \frac{[(p - r) + r]\,[(p - r) - r]}{2p(p - 2r)}$$

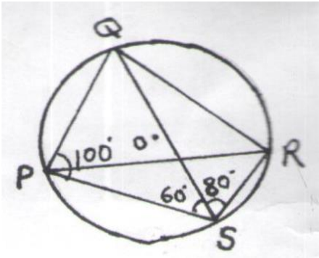
[Applying "Difference of Two Squares" principle at the numerator i.e.
$A^2 - B^2 = (A + B)(A - B)$]

$$= \frac{(p)(p - 2r)}{2p(p - 2r)} = \frac{p}{2p} = \frac{1}{2}$$ Ans. A

Now, try this:

Simplify: $\frac{(a+b)2-b2}{3a2+6ab}$ Ans. = $^1/_3$

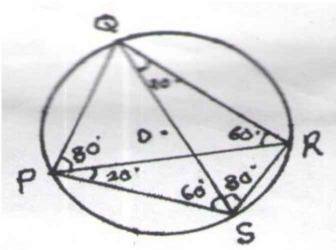
41.



In the diagram, O is the centre of the circle, <QPS = 100^0, <PSQ = 60^0 and <QSR = 80^0. Calculate <SQR. A. 20^0 B. 40^0 C. 60^0 D. 80^0

Solution:

Consider the analysis in the diagram below:



<QPR = 80^0 (Angles in the same segment are equal i.e. <QPR = <QSR)

:. <SPR = 20^0 (i.e. 100 – 80 = 20^0 , since <QPS = 100^0)

:. <SQR = 20^0 (Angles in the same segment are equal i.e. <SQR = <SPR) Ans: A

Now try this:

From the question, determine <PRS. Ans. = 20^0

42. A bag contains 5 red and 4 blue identical balls. If two balls are selected at random from the bag, one after the other, with replacement, find the probability that the first is red and the second blue.
   A. $^2/_9$ B. $^5/_{18}$ C. $^{20}/_{81}$ D. $^5/_9$

Solution:

Number of red balls = 5 , Number of blue balls = 4 ,

Total number of balls = 5 + 4 = 9

:. Pr(1^{st} ball is red) = $^5/_9$

With replacement of the 1^{st} ball picked, the total number of balls would still be 9.

So, Pr(2^{nd} ball is blue) = $^4/_9$

:. Pr(1^{st} is red and 2^{nd} is blue) = $\frac{5}{9} \times \frac{4}{9} = \frac{20}{81}$ Ans: C

Now, try this:

From the question, assuming that the balls are picked from the bag without replacement, find the probability that the first is red and the second is blue. Ans = $^5/_{18}$

43. The relation $y = x^2 + 2x + k$ passes through the point (2, 0). Find the value of k.
   A. -8 B. -4 C. 4 D. 8

Solution:

Note: Whenever a line/curve passes through a point, if you substitute the coordinates of the point into the relation, then, LHS would be equal to the RHS. So, substituting (2, 0) into the relation $y = x^2 + 2x + k$ gives:

$0 = 2^2 + 2(2) + k$ ⟶ $0 = 4 + 4 + k$ ⟶ $0 = 8 + k$

:. $k = -8$ Ans: A

Now, try this

The relation $y = x^2 - 3x + k$ passes through the point (-2, 0). Find the value of k.

Ans. $k = -10$

44. Find the next three terms of the sequence 0, 1, 1, 2, 3, 5, 8, ….

A. 13, 19, 23 B. 9, 11, 13 C. 11, 15, 19 D. 13, 21, 34

Solution:

Note: Whenever you are given questions of this nature, just try to establish how every term of the sequence is obtained. That's all. With this, you'll be able to get other unknown terms. So, here,

0, 1, 1, 2, 3, 5, 8 ….. Add two consecutive terms to get the next one. Di you get that? That is: 0 + 1 = 1, 1 + 1 = 2, 1 + 2 = 3, 2 + 3 = 5

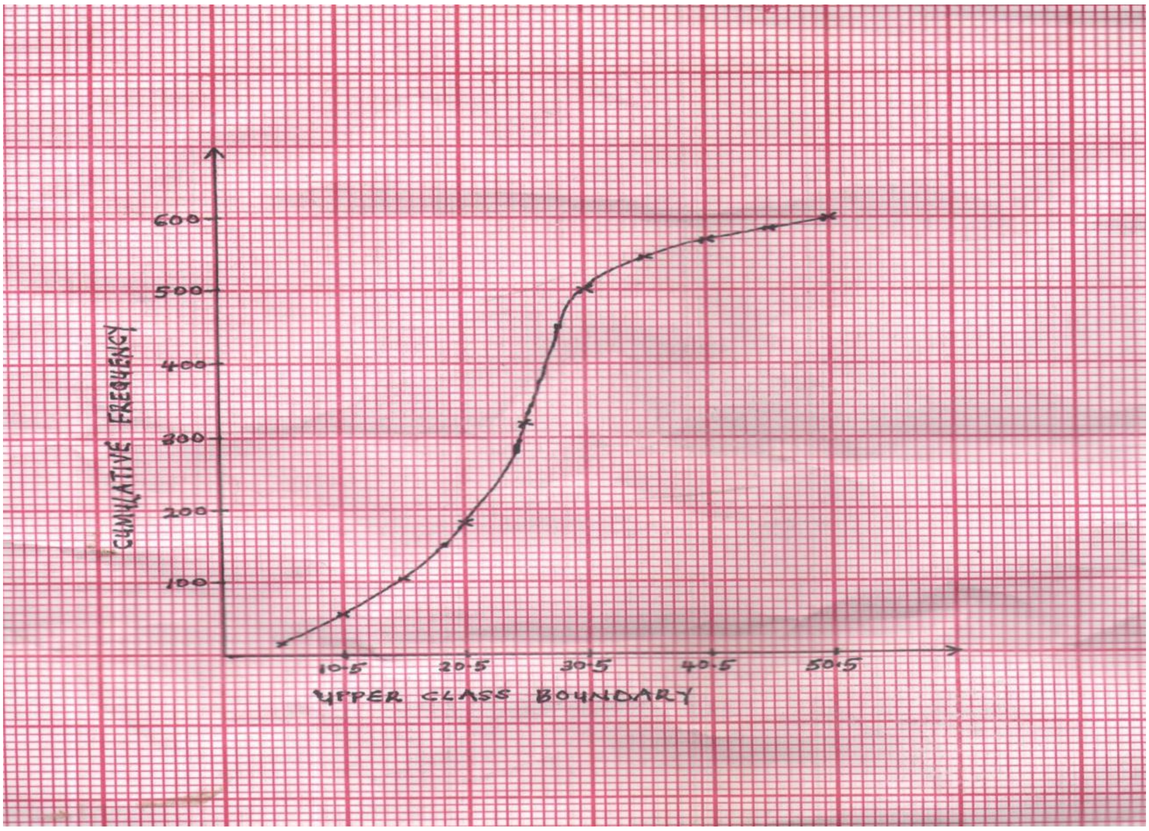
3 + 5 = 8, :. 5 + 8 = <u>13</u> 8 + 13 = <u>21</u>

13 + 21 = <u>34</u> :. The next three terms of the sequence are: 13, 21, 34 . Ans. D

Now, try this:

Find the next three terms of the sequence: 0, 1, 1, 2, 3, 7 …. Ans. = 16, 65, 321 .

45.



Find the lower quartile of the distribution illustrated by the cumulative frequency curve.

A. 17.5 B. 19 C. 27.5 D. 28

Solution:

Lower quartile (Q_1) of the distribution is the x value that is equivalent to ¼ of 600.

¼ of 600 = ¼ x 600 = 150

From the graph, if you trace 150 on the vertical axis to the curve, you would get 19 as the equivalent x value. :. The lower quartile (Q_1) of the distribution = 19 Ans: B

Now, try this:

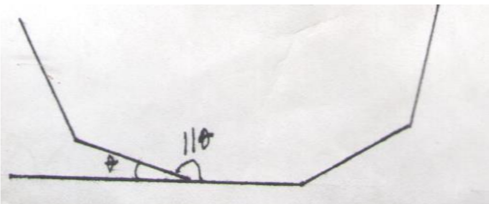
From the graph, determine the upper quartile of the distribution. Ans. = 28

46. The ratio of the exterior angle to the interior angle of a regular polygon is 1:11. How many sides has the polygon?

A. 30 B. 24 C. 18 D. 12

Solution:

From the illustration, we have the following analysis:



If the exterior angle is θ, then, interior angle would be 11θ. Remember, sum of adjacent exterior and interior angle is 180^0 (Angle. on a straight).

So,

$\theta + 11\theta = 180$, ⟶ $12\theta = 180$, :. $\theta = \frac{180}{12}$:.$\theta = 15^0$. Hence, if the exterior angle is 15^0, then, interior angle would be $180 - 15 = 165^0$.

Remember, sum of exterior angles of any polygon is 360^0. So, if the number of sides of the polygon is n, then:

$n\theta = 360$ ⟶ $n(15) = 360$, $15n = 360$:. $n = \frac{360}{15}$:. n = 24 Ans: B

Now, try this:

The ratio of the exterior angle to the interior angle of a regular polygon is 1:5. How many sides has the polygon? Ans. = 12 sides

47. Halima is n years old. Her brother's age is 5 years more than half of her age. How old is her brother? A. $\frac{n}{2} + \frac{5}{2}$ B. $\frac{n}{2} - 5$ C. $5 - \frac{n}{2}$ D. $\frac{n}{2} + 5$

Solution:

Halima's age = n years (Given). Half of Halima's age = $\frac{n}{2}$

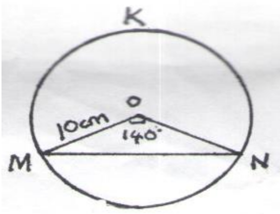
We are told that her brother's age is 5 years more than half of her age.

:. Her brother's age = $\frac{n}{2} + 5$ Ans: D

Now, try this:

Hauwa is p years old. Her brother's age is 3 years less than a quarter of her age. How old is her brother? Ans = $(\frac{p}{4} - 3)$ years

48.



In the diagram, $\overline{MN}$ is a chord of a circle KMN centre O and radius 10cm. If <MON = 140^0, find, correct to the nearest cm, the length of the chord MN

A. 19cm B. 18cm C. 17cm D. 12cm

Solution:

/ON/ is also 10cm. (Radius).

The shortest way to determine /MN/ here is by applying Cosine Rule. So,

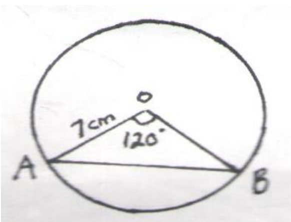
$/MN/^2 = 10^2 + 10^2 - 2(10)(10)\cos 140 = 100 + 100 - 200\cos 140$

$= 200 - 200(-0.7660) = 200 + 153.21$

$/MN/^2 = 353.21$:. $/MN/ = \sqrt{353.2} = 18.79 \approx 19$cm Ans: A

Now, try this:

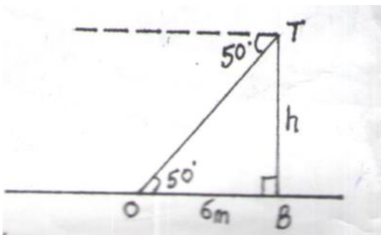
From the diagram provided below, determine the length of the chord AB, correct to the nearest cm. Ans. = 12cm



49. An object is 6m away from the base of a mast. If the angle of depression of the object from the top of the mast is 50^0, find correct to 2 decimal places, the height of the mast. A. 8.60m B. 7.83m C. 7.51m D. 7.15m

Solution:

From the illustration, we have the following interpretation:



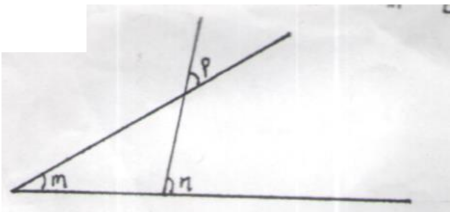
O represents the object, BT represent the mast. B represents the base of the mast. T represents the top of the mast and h is the height of the mast. Note that, angle of depression and angle of elevation of a given problem are the same. (Alternate angles).

So, < TOB = 50^0, tan 50 = $\frac{h}{6}$, :. h = 6 tan 50 = 7.15cm Ans. D

Now, try this

From the question, determine the distance of the object from the top of the mast, correct to 2 decimal places. Ans. = 9.33m

50.

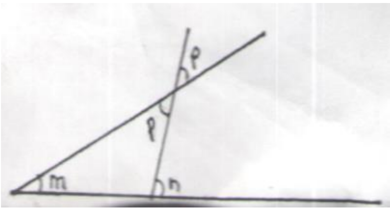


From the diagram, which of the following is true?

A. m + n + p = 180^0 B. m + n = 180^0 C. m = p + n D. n = m + p

Solution:

Consider the analysis is the diagram below:



Remember, exterior angle of a triangle is equal to the sum of two interior opposite angles.

:. n = m + p Ans: D

Now, try this:

From the question, if n = 70^0 and p = 20^0, find m. Ans: m = 50^0

WASSCE JUNE 2016 GENERAL MATHEMATICS
MATHEMATICS (CORE) 2 ESSAY QUESTIONS
SECTION A (PART 1)

1. (a) Without using Mathematical tables or calculators, evaluate $\frac{0.09 \times 1.21}{3.3 \times 0.0025}$,

leaving the answer in standard form (Scientific Notation).

Solution:

$\frac{0.09 \times 1.21}{3.3 \times 0.0025}$ (Given)

In the questions like this, just eliminate the decimal fractions by moving the decimal points (for numerator and denominator) equal number of places to the right.

For 0.09, move the decimal point 2 places to the right and 0.09 becomes 9.
For 1.21, move the decimal point 2 places to the right and 1.21 becomes 121. Altogether, we have move decimal point at the numerator 4 places to the right.

We need to move the decimal point at the denominator 4 places to the right too. So, for 3.3, move the decimal point 1 place to the right and 3.3 becomes 33. For 0.00025, move the decimal point 3 places to the right and it becomes 0.25. So, we now have:

$$\frac{0.09 \times 1.21}{3.3 \times 0.0025} = \frac{9 \times 121}{33 \times 0.25}$$

To clear decimal fraction completely, move the decimal point 2 places to the right for the both the numerator and denominator. With this, we now have:

$$\frac{900 \times 121}{33 \times 25} = \frac{36 \times 11}{3 \times 1} = 12 \times 11 = 132 = 1.32 \times 10^2$$ (Answer)

Now try this:
Without using Mathematical tables or calculators, evalulate $\frac{0.24 \times 0.035}{0.15 \times 0.002}$,

leaving the answer in standard form (Scientific Notation). Ans = 2.8×10^1

1(b) A principal of GH¢5600 was deposited for 3 years at compound interest. If the interest earned was GH¢1200, find, correct to 3 significant figures, the interest rate per annum.

Solution:
1(b) This is a question on Compound Interest. Can you still remember Annual Compound Interest formula?
The formula is: $A = P(1 + \frac{r}{n})^{nt}$

where:

A: the future value of the investment/loan (i.e. principal + interest)

P: the principal

R: the rate (This should be converted to decimal.)

n: the number of times the interest is compounded per year

t: the number of years the money is invested or borrowed for.

So, from the given question, P = GH¢5600, t = 3 years, A = GH¢5600 + GH¢1200 = GH¢6800, n = 1 (The interest rate is per annum.) ; r = ? Hence :

$6800 = 5600 (1 + \frac{r}{1})^{(1)3}$ ⟶ $6800 = 5600 (1 + r)^3$, $\frac{6800}{5600} = (1 + r)^3$, $(1 + r)^3 = 1.214286$, $1 + r = \sqrt[3]{1.214283}$,

1 + r = 1.066859 :. r = 1.066859 – 1 = 0.066859 :. r = 0.0669 (Answer)

This is equivalent to 6.69% interest rate.

Now, try this:

Find the interest rate (with annual compounding) if an investment of GH¢9000 grows to GH¢17118 in 16 years. Ans. 4 = 4.1%

2. (a) Solve: $7(x + 4) - \frac{2}{3}(x - 6) \leq 2[x - 3(x + 5)]$

Solution:

$7(x + 4) - \frac{2}{3}(x - 6) \leq 2[x - 3(x + 5)]$ Multiplying all through by 3 to clear faction gives:

$21(x + 4) - 2(x - 6) \leq 6[x - 3(x + 5)]$ ⟶

$21x + 84 - 2x + 12 \leq 6[x - 3x - 15]$ ⟶

$21x + 84 - 2x + 12 \leq 6[-2x-15]$ ⟶

$19x + 96 \leq -12x - 90$ ⟶ $19x + 12x \leq -90 - 96$, $31x \leq -186$,

$\therefore\ x \leq -\frac{186}{31}$ $\therefore\ x \leq -6$ (Answer)

Now try this:

Solve: $5(x + 2) - \frac{1}{2}(x - 4) \leq -2[x - 3(x + 3)]$ Ans: $x \leq 12$

2(b) A transport company has a total of 20 vehicles made up of tricycles and taxicabs. **Each** tricycles carries 2 passengers while **each** taxicabs carries 4 passengers. If the 20 vehicles carry a total of 66 passengers at a time, how many tricycles does the company have?

Solution:

Note: This is an applied question on simultaneous equations.

Let the number of tricycles be x and let the number of taxicabs be y. So, from the 1st sentence in the question, $x + y = 20$…………..(i)

From the 2nd sentence, $2x + 4y = 66$…………..(ii)

Let's use elimination method to solve the simultaneous equations:

$2x + 4y = 66$……………(ii)

$-$ $\underline{4x - 4y = -80}$…………..(i) (Multiplying equation (i) by -4)

$-$ $2x = -14$

$\therefore\ x = \frac{-14}{-2}$ $\therefore\ x = 7$ (Answer)

$\therefore$ The company has 7 tricycles.

Now, try this:

A man has a total of 12 automobiles made up of tricycles and motorcycles. **Each** tricycle carries 3 passengers while **each** motorcycle carries 2 passengers. If the 12 automobiles carry a total of 29 passengers at a time, how many motorcycles does the man have?

Ans. = 7 motorcycles