

And = X ⇒
OR = +

Probability of getting a 6 and a 2
 $\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$

probability of rolling a 6 or a 2
 $\frac{1}{6} + \frac{1}{6} = \frac{1}{3}$

Remember:
 $4! = 4 \times 3 \times 2 \times 1$

Probabilities lie between 0 and 1
0 being impossible
1 being certain

Binomial trials
Combining two events
eg Find the probability of tossing a tails and throwing a 6

Expected Value

Outcome (X)	Probability P(X)	X * P
€10	$\frac{1}{2}$	€5
€4	$\frac{1}{4}$	€1
€5	$\frac{1}{4}$	€1.25
		€7.25



if it cost more than the expected value to play the game then in the long run we will lose money.
if it cost to play = E.V. then it is a "Fair Game".

Probability

Expected Frequency = Probability x number of trials

Sample Space Diagram

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

Permutations

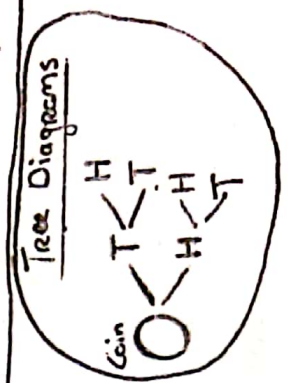
- How many ways can we arrange the letters A, B, C, D.
Answer $4 \times 3 \times 2 \times 1 = 24$.
- If the word must begin with A
answer $1 \times 3 \times 2 \times 1 = 6$
- If the word must begin with A and the next letter B
answer $1 \times 1 \times 2 \times 1 = 2$
- If we can repeat the letters
answer $4 \times 4 \times 4 \times 4 = 256$

Theoretical Probability

$$P[E] = \frac{\text{Number of successful outcomes}}{\text{Total number of possible outcomes}}$$

eg Probability of picking an Ace from a deck.
 $= \frac{4}{52}$

Probability of an event not happening is $1 - \text{probability of the event happening}$

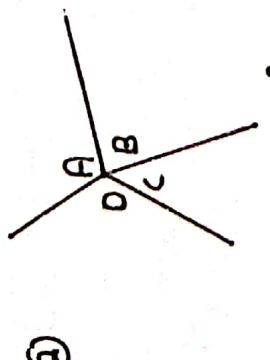


Relative frequency
R.F. = $\frac{\text{Number of successful trials}}{\text{Total number of trials}}$

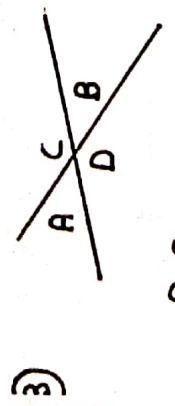
Properties of Angles



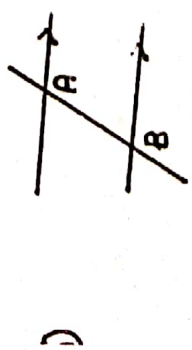
$A + B + C = 180^\circ$



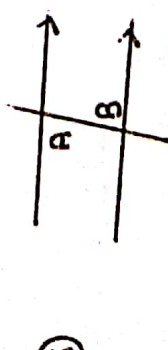
$A + B + C + D = 360^\circ$



$A = B \quad C = D$

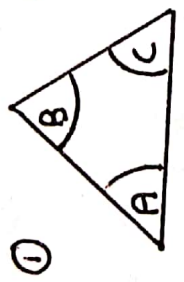


$A = B$ [Corresponding Angles]

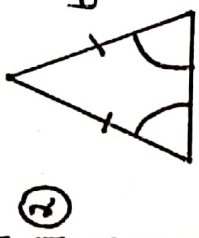


$A + B = 180^\circ$ [Alternate Angles]

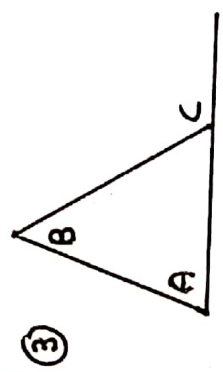
Triangle Properties



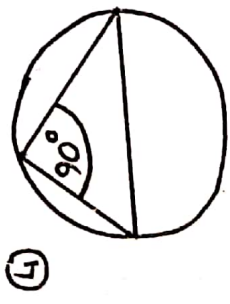
$A + B + C = 180^\circ$



In an isosceles triangle the base angles are equal



$C = A + B$



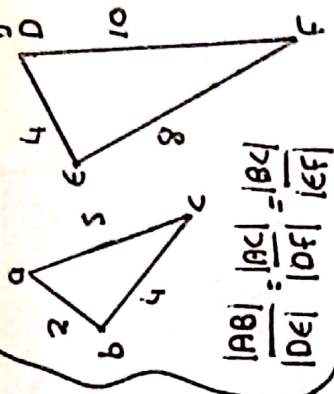
angle in a semi circle is always 90°

Congruent Triangles

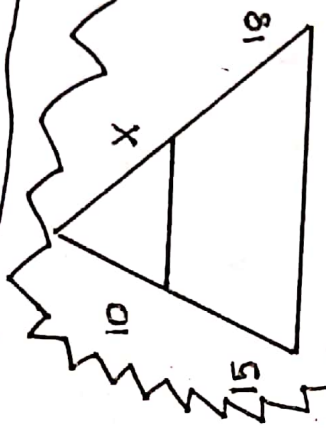
[the same]

- Side Side Side
- Side Angle Side
- Angle Side Angle

Similar Figures



$\frac{|AB|}{|DE|} = \frac{|BC|}{|EF|} = \frac{|AC|}{|DF|}$

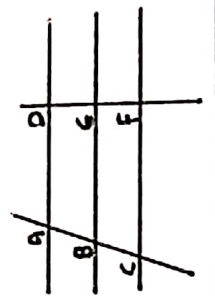


$\frac{10}{15} = \frac{x}{18}$
 $15x = 180$
 $x = 12$

Cross multiply



Parallel Lines and transversals



if $|AB| = |BC|$ then $|DE| = |EF|$

Area of triangle = $\frac{1}{2}$ base \times Perpendicular Height

Area of parallelogram = Base \times Perpendicular Height

* Know: Theorems, Constructions, Enlargements

To find the X intercept let $y = 0$ and solve.
 To find the y intercept let $x = 0$ and solve.

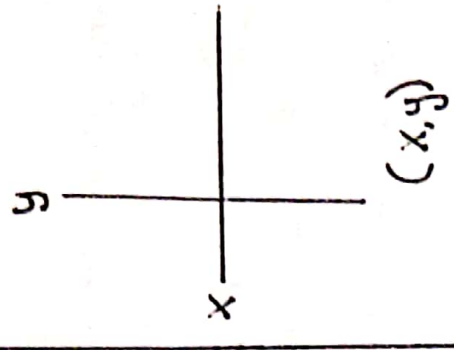
If we are asked to draw a line when given its equation... we find the X and the y intercept and join them.

Drawing Graphs

eg Draw $g(x) = x^2 - 2x - 3$ in the domain $-2 \leq x \leq 2$

X	$x^2 - 2x - 3$	y	point
-2	$(-2)^2 - 2(-2) - 3$	5	(-2, 5)
-1			
0			
1			
2			

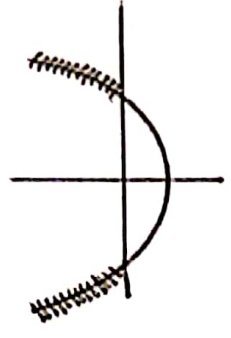
* when we have all the points we can draw the graph



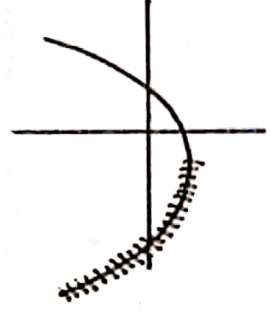
Functions

Remember: $g(x)$ is just another name for y

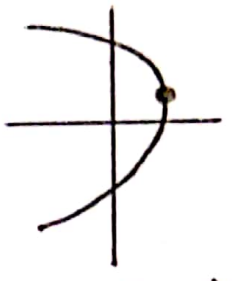
= positive
 — = negative
 [read from X axis]



= decreasing
 — = increasing
 [read from X axis]



Min point = (x, y)
 min value = lowest y value



* Finding the roots of an equation.
 [where the line crosses the X axis]
 Let equation = 0 and solve.

* Find $g(x) = 2$
 Go to 2 on y axis, draw horizontal line. to where it hits the curve.
 Now draw a vertical line to X axis. from here
 Our X value is the answer.

* Find $g(2)$
 Go to 2 on X axis.
 Draw vertical line to where it hits curve
 Now Draw a horizontal line from here to y axis
 Our y value is our answer

Compound Interest

$$F = P(1+i)^t$$

Depreciation

$$F = P(1-i)^t$$

Foreign Exchange

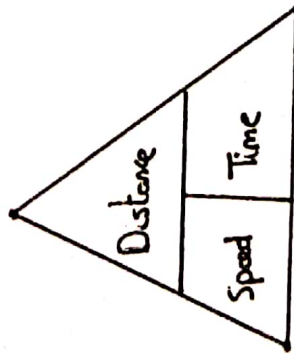
$$£1 = \$1.20$$

Find €150

$$\begin{array}{l|l} £1 = £1.20 & \times 150 \\ \hline €150 = ? & \end{array}$$

Commission is taken away at the end.

Arithmetic



Ratios

Divide €100 into the ratio

8:2

+ add $8+2 = 10$

* divide €200 by 10 = 20

* multiply 20 by 8 = 160

* multiply 20 by 2 = 40

∴ €40 : €160

Income Tax

Cut off point: you are taxed at the lower rate up to this amount

Any amount you earn more than this is taxed at the higher rate.

Tax credit: money taken away from tax owed

Gross: Wages before deductions

Net: Wages after deductions

Percentages

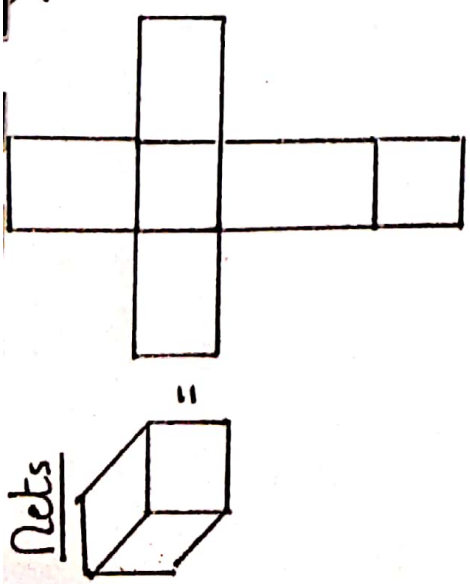
Remember: Cost price and price excluding vat is 100%

Sell price and price excluding vat is 100% + vat;

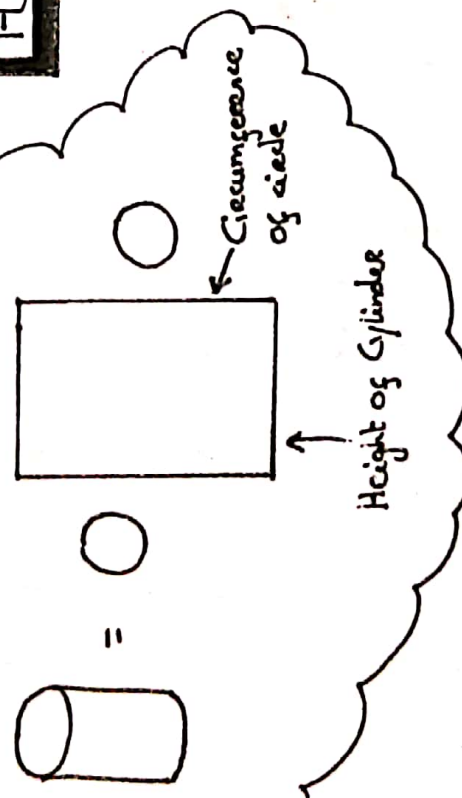
So if a sofa cost €242 inclusive of Vat [21%] find the cost exclusive of Vat.

Divide €242 by 121 to get 1% and multiply answer by 100 to get 100 [which is the price excluding Vat]

Nets



Area and Volume



Formula in Log Book

- Remember: Perimeter and Circumference measured in cm, m etc
- Area measured in cm^2
 - Volume measured in cm^3

Sometimes we need to use Pythagoras theorem

Equal Volumes



Water rises by the same volume as what was put in.

∴ Vol of sphere = raise in vol of water which is now in the shape of a cylinder.

So we let $\bullet = \bullet$

$$\frac{4}{3} \pi R^3 = \pi r^2 H$$

Fill in the blank

Finding T_n [the n^{th} term] of an arithmetic sequence

$$T_n = a + (n-1)d$$

$a = 1^{\text{st}}$ term

$d = \text{difference}$

Arithmetic Series

[Sum of]

$$S_n = \frac{n}{2} \{ 2a + (n-1)d \}$$

1^{st} term

Difference

* Remember: $T_n = S_n - S_{n-1}$

Quadratic Sequence

$$T_n = an^2 + bn + c$$

3 10 21 36

7 11 15

4 4 4 $\leftarrow a = \text{half } 2^{\text{nd}}$ difference.

Is $T_n = 4n - 3$

Find T_2

$$T_2 = 4(2) - 3 = 5$$

Each number in a sequence is called a term.

T_1 stands for the first term

T_4 stands for the fourth term.

T_n stands for a general term/formula to help you calculate any term in the sequence

Number Patterns

$$T_n = 4n - 3$$

What term will give 11

- We could use trial and error
- Better to let $4n - 3 = 11$ and work back to find n

Types of Sequence

① 5 7 9 11 13
 2 2 2 2
 Arithmetic
 [1st difference is equal]

② 3 6 11 18 27
 3 5 7 9
 2 2
 Quadratic
 [2nd difference is equal]

④ 2 4 8 16 32 Exponential.

$$T_n = 2n^2 + bn + c$$

We find b and c using sim. equations.

eg $T_1 = 3$

$$\therefore 2(1) + b(1) + c = 3$$

$$b + c = 1$$

$$T_2 = 10$$

$$\therefore 2(2) + b(2) + c = 10$$

$$4 + 2b + c = 10$$

Now use sim eq.

$$2b + c = 6$$

$$b + c = 1$$

Rules of Multiplication

Like signs give + answer
 Unlike signs give - answer

eg $(3)(4) = 12$
 $(-3)(4) = -12$
 $(-3)(-4) = 12$
 $(3)(-4) = -12$

Natural numbers N:

any whole number
 $\leftarrow -3 -2 -1 0 1 2 3 4$

Integers Z:

any number
 $\leftarrow -3 -2 -1 0 1 2 3 4$

Real numbers R:

$\leftarrow -3 -2 -1 0 1 2 3 4$

Sim. Equations: One linear and one quadratic

$X + y = 3$ ①
 $X^2 + y^2 = 17$ ②
 * write ① in terms of y, $X = 3 - y$
 * put this in for x in ②

* Now solve for y.
 * When you find y put the answer back into ① and solve for x

Simultaneous Equations

$2x - 5y = 9$
 $3x + 2y = 4$
 * Remember: get a positive and negative pair

Rules of Addition

* When the signs are the same, we add the numbers and use the common sign
 * When the signs are different, we subtract the numbers and use the sign of the bigger number

eg $4+3 = 7$
 $-4-3 = -7$
 $-4+3 = -1$
 $4-3 = 1$

Multiplying brackets

$(4x+3)(2x-4)$
 $8x^2 - 16x + 6x - 12$
 $8x^2 - 10x - 12$

Laws of Indices

$L^2 \times L^3 = L^5$
 $\frac{L^5}{L^2} = L^3$
 $(L^2)^3 = L^6$
 $L^0 = 1$

Algebra

Solving Algebraic Fractions

$\frac{x+4}{3} - \frac{x+2}{4} = \frac{7}{6}$ LCM = 12

$\frac{4(x+4) - 3(x+2) = 2(7)}{12}$
 new ignore denominator and solve for x

Adding Algebraic Fractions

$\frac{5}{x+3} + \frac{2}{x-4}$
 $\frac{5(x-4) + 2(x+3)}{(x+3)(x-4)}$
 $\frac{5x-20+2x+3}{(x+3)(x-4)}$

Simplifying

$3x^2 + 4x + 3y + 2 + x^2 + 3y + 2y + 4$
 $4x^2 + 4x + 8y + 6$

4 ways to factorise

1) HCF eg $4x - 8$
 $4(x - 2)$

2) Grouping

$2d + 4d + 3a + 6ac$
 $2d(1+2c) + 3a(1+2c)$
 $(2d+3a)(1+2c)$

3) Difference of two squares

eg $9x^2 - 16$
 $(3x - 4)(3x + 4)$

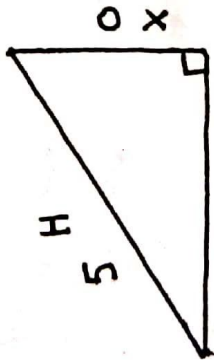
4) Factorising Quadratics

eg $X^2 + 6x + 9$
 $(x+3)(x+3)$ Solving
 OR $-b \pm \sqrt{b^2 - 4ac}$
 $X+3=0$ $X+3=0$
 $X=-3$ $X=-3$

Pythagoras' Theorem

- * Used in a right angle triangle.
- * Used when we have the length of two sides and want to find the length of the 3rd side

$$H^2 = A^2 + O^2$$



$$H^2 = A^2 + O^2$$

$$5^2 = 4^2 + 0^2$$

$$25 = 16 + 0^2$$

$$9 = 0^2$$

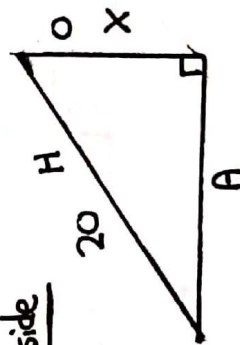
$$3 = 0$$

Trigonometry

C
A
H
S
H
T
A

Could a hungry stupid osterich have taken over america

Finding the side



We use Sin because we have H and we want to find O

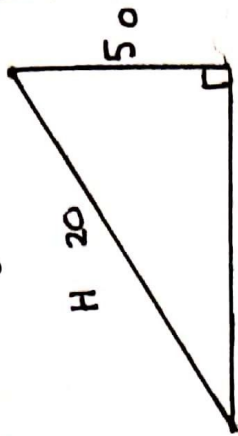
$$\sin 30^\circ = \frac{x}{20}$$

$$0.5 = \frac{x}{20}$$

$$0.5 \times 20 = x$$

$$10 = x$$

Finding the angle



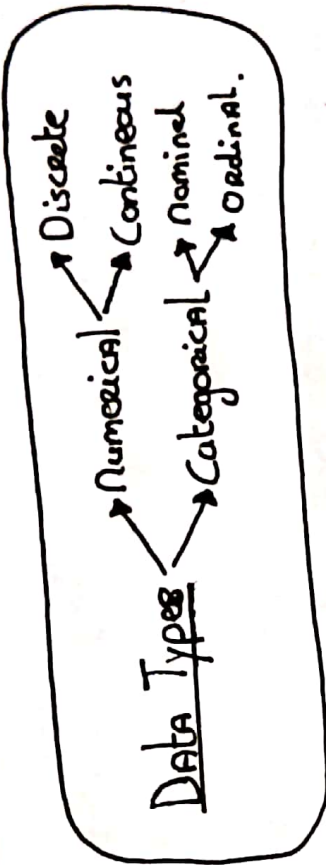
* We use Sin because we have O and H

press **Shift** **Sin** $\frac{5}{20} =$

Answer 14°

Desk Research / Field Research
[Secondary Data] [Primary Data]

Mode: Most common number
Median: List from smallest to biggest and choose the middle number
Mean: Add the numbers and divide answer by number of numbers



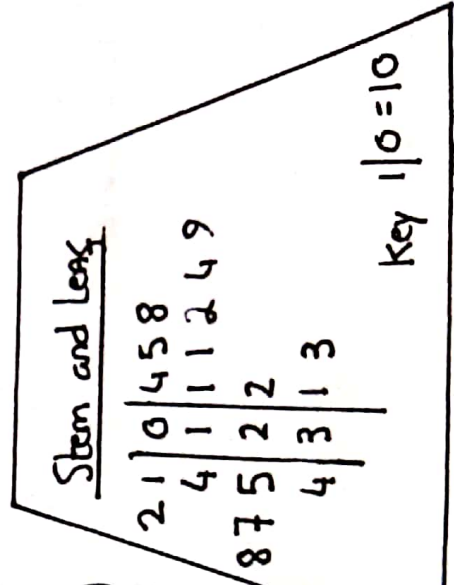
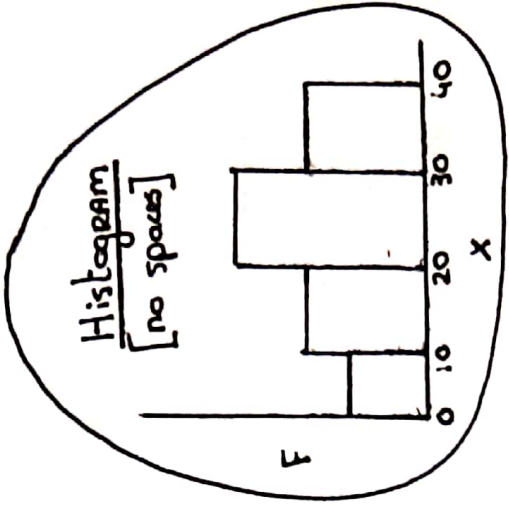
Statistics

Range: Biggest number - smallest number
Inter quartile range:
 2 3 ⑤ 6 7 ⑨ 11 12 ⑭ 16 17
 ↓ ↓ ↓
 Q1 Q2 Q3
 IQR = Q3 - Q1

might need to use mid interval values

Frequency Table

Value	1	2	3	4
Frequency	2	4	3	1



Mode: Value above most common frequency.
Median: Add all frequencies.
 • Divide answer by 2.
 • Find which frequency brings you up to this number

Mean: $\frac{2(1) + 4(2) + 3(3) + 1(4)}{2 + 4 + 3 + 1} = 2.3$

Formula in Log book

- Distance
- Mid Point
- Equation
- Slope

Finding the equation of a line
 put the slope and one point into $y - y_1 = m(x - x_1)$ and simplify

Finding the slope when given the equation.
 write equation in the form $y = mx + c$
 m is the slope

Remember: Parallel lines have the same slope.
 perpendicular lines slopes multiply to -1
 To get a perpendicular slope, turn upside down and change one sign.
 eg $\frac{3}{5}$ is perpendicular to $-\frac{5}{3}$

To find where two lines cross each other we use Simultaneous Eq.

Drawing a line from an equation

- * Let $y = 0$ and solve for x
 This will get you the x intercept
- * Let $x = 0$ and solve for y .
 This will get you the y intercept.
- * Join both points

To check if a point is on a line.
 eg check if $(4, 2)$ is on the line $2x + 3y = 13$
 Slot 4 and 2 in for x and y
 $2(4) + 3(2) = 13$
 $8 + 6 = 13$
 $14 = 13$
 Not true. $\therefore (4, 2)$ is not on the line

The Line

If you find that the line passes through the point $(0, 0)$ then let $x = 1$ and solve for y and let $y = 1$ and solve for x

Translation	axial Symmetry [through x axis]	axial Symmetry [through y axis]	central Symmetry (through the origin)
