Arithmetic & Financial Maths

A) % Error:

$$Error = |True\ value - Estimate|$$

$$Percentage\ Error = \frac{Error}{True\ value} \times \frac{100}{1}$$

B) Exchange Rates: $€1 = \$1.37$, $€? = \$2,500$

$$\%\ PROFIT / LOSS = \frac{PROFIT / LOSS}{COST\ PRICE} \times \frac{100}{1}$$

Q. Including commission, Find cost.

Use: The Cross Method ⇒ Cross multiply the diagonals and divide by the number diagonally across from the unknown?

C) Scientific/Index Notation: *Use the calculator:* $\times 10^x$ *or* EXP

Q. Writing big and small numbers in the form $a \times 10^n$, *where* $1 \le a < 10$.

Q. Write $a \times 10^n$ *as a decimal.*

D) Speed/Distance/Time:

$$Speed = \frac{Distance}{Time}\left(km/hr\right)$$

Use calculator: $D°M'S''$ *for Time Q's.*

E) VAT:

$Goods = 23\%$

$Services = 13.5\%$

$$Rate(\%)\ of\ VAT = \frac{VAT}{Cost} \times \frac{100}{1}$$

F) Compound Interest:

$$A = P\left(1 + \frac{r}{100}\right)^n$$

$$Interest = Amount - Principal$$

$$Rate(\%)\ of\ interest = \frac{Interest}{Principal} \times \frac{100}{1}$$

$$F = P(1 \pm i)^t$$

G) Income Tax:

$Standard\ Rate = 20\%$

$Higher\ Rate = 40\%$

$USC\ \&\ PRSI\ must\ be\ known\ too$

Cutoff Point = €35,300
Tax Credits = €3,300
(Single&PAYE)

$$Net\ Tax\ Paid = Gross\ Tax\ Due - Tax\ Credits$$

$$Gross\ Income = Standard\ Rate\ Cut-off\ Point + Income\ Above\ Standard\ Rate\ Cut-off\ Point$$

$$Net\ Income = Gross\ Income - Net\ Tax\ Paid$$

H) Fractions/Decimals/Ratios/Percentages: (Basic Arithmetic)

Must learn to deal with objects divided up into parts!

Algebra

A) Manipulation of Formulae:

Rules: $+ \to -,\ - \to +,\ \times \to \div,\ \div \to \times,\ \sqrt{\ } \to (\ )^2,\ (\ )^2 \to \sqrt{\ }$

Q. Express x in terms of $a, b, c, ...$ *etc.*

B) Inequalities:

Sets: $\mathrm{N}, \mathrm{Z}, \mathrm{R}, \mathrm{Q}$ *and* C

Signs: $<\ ,\ >\ ,\ \leq\ ,\ \geq,$ *pg*.23 *tables*

Q. Find the solution set of ...

Q. Solve the inequality...and indicate the solution set on the number line.

C) Indices:

Rules: *pg*.21 *tables*

Q. Write as a power of $...2, 3, 5,$ *etc.*.

Q. Solve for x, the equation.

D) Quadratic Equations & the Quadratic Formula:

Q. Factorise.

Q. Solve for x, 2 *roots* (*solutions*). $\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ *pg*.20 *tables*

$\Rightarrow$ $x^2 - x(\text{Sum of roots}) + \text{Product of roots} = 0$

E) Algebraic Fractions:

Q. Write as a single fraction. (*Find a common denominator*)

Q. Solve for x; correct to..decimal places / give answers in the form $a \pm \sqrt{b}$.

(*Multiply every term by the bottom of the fractions*)

F) Simultaneous Equations:

Where two lines intersect /
where a line intersects a circle

Q. Solve for x and y.

G) Surds and Quadratic Functions:

$(x + \sqrt{x})(x - \sqrt{x})$

Q. Simplify and solve for x.

H) Word Problems:

Be able to read through a Q and form your own expressions and equations.

Look out for words like:

Sum of (*total*) = +
Difference of = -
Product of = ×
Quotient of = ÷ .....use the formula $y = mx + c$ *or* $Tn = a + (n-1)d$

Complex Numbers

1) Addition: $(2+3i)+(1-5i)$

Q. Simplify and write your answer in the form $a+bi$.

2) Subtraction: $(2+3i)-(1-5i)$

Q. Simplify and write your answer in the form $a+bi$.

3) Multiplication: $(2+3i)(1-5i)$

Q. Simplify and write your answer in the form $a+bi$, *where* $i^2=-1$

4) Division: $\dfrac{2+3i}{1-5i}$

Multiply by the conjugate of the bottom complex number.

Conjugate: change the sign of the i part.

Q. Simplify and write your answer in the form $a+bi$.

5) Plotting on an Argand Diagram:

$y-axis = the\ imaginary\ axis$

$x-axis = the\ real\ axis$

6) | Modulus |: $\sqrt{a^2+b^2}$

Distance(*length*) *from a complex number to the origin* $(0,0)$

7) Verifying roots of Quadratic Equations:

Sub in the complex number, the answer $=0$

8) Solving Quadratic Equations: $2\ roots = \overline{conjugates}$

Use: $\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ *pg.*20 *tables, where* $i=\sqrt{-1}$.

9) Transformations:

i) Rotations:

multiply by: $i=\sqrt{-1},\ i^2=-1, i^3=-1i$ *and* $i^4=1$

Anticlockwise rotations: 90°, 180°, 270° *and* 360°, *respectively*

ii) Translations:

Addition and subtraction of Re *and* Im *parts to complex numbers*

iii) Dilations:

mulyiply by any Re*al number K, if K is - we get Central Symmetry*

$-1\le k\le 1$ *REDUCTION* $-1\ge k\ge 1$ *ENLARGEMENT*

Calculus

A) Rule for Differentiation:

Multiply the power by the number in front of the letter x, *then* -1 *away from the power*

- *If you don't see a power, the answer is the number in front of the letter* (x)
- *If you don't see a letter* (x), *just a number* $(cons\tan t)$, *the answer is Zero*
- *Fraction with letter on bottom* $\left(\frac{1}{x^2}\right)$, *rearrange and change sign of power, then differentiate*
- *Fraction with letter on top* $\left(\frac{3x^4}{4}\right)$, *differentiate the top and simplify*

B) Max and Min Turning points:

$$f'(x) / \frac{dy}{dx} = slope = 0$$

*Tangents to the curve are horizontal at the turning po*int *s*
$m = 0$

C) Rates of Change:

$$Speed = \frac{distance}{time}\left(ms^{-1}\right), \quad Speed = 0 \text{ when object stops / at rest / at max height}$$

$$Acceleration / Deceleration = \frac{change\ in\ Speed}{time\ taken}\left(ms^{-2}\right) / f''(x) = change\ in\ slope$$

D) Equation of a Tangent to a curve: $y - y_1 = m(x - x_1)$ *pg.* 18 *tables*

$$f'(x) / \frac{dy}{dx} = m \ @ \ (x_1, y_1)$$

$$Slope\ of\ curve = slope\ of\ tangent\ at\ (x_1, y_1)$$

***Type 1*: Given Point/ x-value of point (x_1, y_1)**

***Type 2*: Given Slope m / information to find m, e.g., Parallel/Perpendicular line equation $y = mx + c$ or Angle that Tangent makes with the x-axis $\tan A = m$.**

Functions & Graphs

A) Functions: (a)'s

Finding x values / co – ordinates when given $f(x)/y$.
Finding y values / co – ordinates when given x, in the form $f(1), f(-1), f(2), f(-2), etc.$
Finding co – ordinates (x, y), *where two functions / graphs touch.*
Finding the value of k in a function, in the form $f(x) = 4 - kx$, *if* $f(-5) = 34$.
Finding where a function cuts the x and y – axes.
Finding a range of values of x for which $f'(x) < or > 0$.

B) Graphs:

Use the calculator or a table to find co – ordinates (x, y), *when given a domain, eg.* $-3 \le x \le 5$.

1) Straight Lines:

Must find two co - ordinates for (x, y) *or* (v, t) *to plot.*

$f(x) = 2x - 1$ *or* $v = \frac{1}{3}(2t + 5)$

2) Quadratic Curves:

$f(x) = x^2 - x - 6$ $\quad +x^2 = happy\ curve$

$f(x) = -2x^2 + 8x - 3$ $\quad -x^2 = sad\ curve$

3) Cubic Curves:

$f(x) = x^3 - x^2 - 9x + 9$ $\quad x^3 = happy\ and\ sad\ curve$

4) Exponential Curves:

$f(x) = 2^x$ *or* 2^{-x}	$f(x) = 3.2^x$
Y - int *ercept* $(0,1)$	Y – int *ercept* $(0,3)$

curve doesn't touch the x - axis $\Rightarrow$ *assymptote*

C) Transformations:

i) Lines: $y = mx + c$

$C = y\text{-intercept}$: *a change in c shifts line up or down*
$M =$ *slope*: *a change in m changes the direction of the line*

ii) Quadratic Curves: $y = ax^2 \pm b$ / $y = (x \pm c)^2$ &

iii) Cubic Curves: $y = ax^3 \pm b$ / $y = (x \pm c)^3$

If $a > 1$ *the curve stretches and narrows and if* $0 < a < 1$ *the curve compresses and widens*
If $a < 1$ *the curve turns upside down and reflects under the x-axis*

If $b > 0$ *the curve shifts up and if* $b < 0$ *the curve shifts down*

If $c > 0$ *the curve shifts to the left and if* $c < 0$ *the curve shifts to the right*

iv) Exponential Curves: $y = a \bullet base^{x \pm h} \pm v$

Where a change in "a" transforms the the graph vertically (*stretching or compressing*)
A *change in "h" shifts the curve left or right*
A *change in "v" shifts the curve up or down*

Area & Volume

A) Areas & Lengths:

$Area, A = The\ amount\ of\ space\ taken\ up\ by\ an\ object\ on\ a\ flat\ surface.$
$(units^2, eg.\ cm^2)$ $pg.\ 8\&9$ $tables.$

$Sector = \left(\frac{\theta^\circ}{360^\circ}\right)\pi r^2$, $Circle = \pi r^2$, $Semi-circle = \frac{\pi r^2}{2}$

$Square\ \&\ Rectangle = L \times W$

$Triangle = \frac{1}{2} base \times \perp height$ or $\frac{1}{2}ah$ or $\frac{1}{2}ab\sin C$

$Length, L = The\ distance\ between\ two\ points.$
$(units,\ eg.\ cm)$ $pg.\ 8\&9$ $tables.$

$Arc = \left(\frac{\theta^\circ}{360^\circ}\right)2\pi r$, $Circle = 2\pi r$, $Semi-circle = \frac{2\pi r}{2} = \pi r$

$Slant\ height\ of\ Cone, l: Pythagoras\ Theorem$
$l^2 = \perp h^2 + r^2$

$Square\ (Perimeter) = 4L\ or\ 4W$, $Rectangle\ (Perimeter) = 2L + 2W$

$Perimeter = Length / Distance\ around\ the\ border\ or\ outside\ of\ an\ object.$

B) Trapezoidal Rule: *Finding the area of an irregular shape.*

$A \approx \frac{h}{2}[1st + last + 2(\text{Re}maining\ Lengths)]$ $pg.12$ $tables$

C) Volumes: *Use*: *Formula = Actual* to find Radius/Height

Volume, V = The internal capacity of an object, i.e., how much an object can hold inside. $\left(units^3, eg.\ cm^3\right)$ *pg.* 10 & 11 *tables.*

$Sphere = \frac{4}{3}\pi r^3$ $\quad Hemisphere = \frac{1}{2}\left(\frac{4}{3}\pi r^3\right) = \frac{2}{3}\pi r^3$

$Cylinder = \pi r^2 h$

$Cone = \frac{1}{3}\pi r^2 h$

$Frustum\ of\ Cone = \frac{1}{3}\pi h\left(R^2 + Rr + r^2\right)$

Volume of a Prism = *Area of Cross Section* × *Length / depth*

Displacement: When a heavy object is placed in a liquid and causes the liquid to move

Archimedes Principle: *The volume of displaced liquid = The volume of the object causing the displacement*

D) Nets:

A Net is a 2D object that can be folded into a 3D shape

- *Find the surface area of 2D object (NET) after unfolding a 3D shape*
- *Cones, Cylinders,* Prisms, Rectangular *Cuboids and cubes*
- *Be able to draw Nets*

The Line
*pg.*18

1) Distance/Length:

$A(x_1, y_1)$ *and* $B(x_2, y_2)$, $|AB| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

2) Midpoint:

$A(x_1, y_1)$ *and* $B(x_2, y_2)$, $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

3) Slope, m:

(i) $A(x_1, y_1)$ *and* $B(x_2, y_2)$, $m = \frac{y_2 - y_1}{x_2 - x_1}$ (*must have* 2 *points*)

(ii) $\boxed{m = \frac{-a}{b}}$ *or* $y = mx + c$ (*must have the Equation*)

(iii) $\boxed{\tan A° = m}$ $(line\ makes\ Angle\ with\ +sense\ of\ x\text{-}axis)$

$\boxed{Parallel\ Lines \rightarrow Same\ Slope}$ $\boxed{Perpendicular\ Lines \rightarrow Multiply\ Slopes = -1}$

4) Equation of a Line:

$y - y_1 = m(x - x_1)$ $\boxed{Need:\ Slope = m\ \&\ Point = (x_1, y_1)}$

5) Point On a Line:

$\boxed{Sub\ Point(x, y)\ into\ Equation,\ both\ sides\ should\ be\ equal!}$

6) Points of Intersection with the Axes:

$\boxed{\begin{array}{l} x - axis: y = 0 \\ y - axis: x = 0 \end{array}}$ $\boxed{Use\ to\ find\ two\ points,\ to\ draw\ a\ Line!}$

7) Point of Intersection between Two Lines: $\boxed{Graphing\ or\ Algebra}$

$\boxed{Use: Simultaneous\ Equations!}$

8) (i) Translation & (ii)Symmetry:

i) $\boxed{Changing\ the\ x\ and\ y\ co-ordinates\ of\ points\ to\ move\ them!}$

ii) $\boxed{\begin{array}{l} Finding\ the\ Images\ of\ points\ by\ moving\ them\ through\ other\ points \\ (Central)\ or\ through\ the\ axes\ (Axial). \end{array}}$

$\boxed{\begin{array}{ll} Moving\ through: & (i)\ the\ x\text{-}axis \rightarrow y\text{-}value\ changes\ sign, \\ & (ii)\ the\ y\text{-}axis \rightarrow x\text{-}value\ changes\ sign, \\ & (iii)\ the\ Origin \rightarrow both\ x\ and\ y - values\ change\ sign. \end{array}}$

9) Real-Life Word Problems: $\boxed{y = mx + c}$

$\boxed{\begin{array}{l} m = rate\ of\ change\ between\ two\ variables \\ \boxed{Speed = \frac{Distance}{Time}},\ \boxed{Independent\ variable: X\text{-}axis} \end{array}}$ $\boxed{\begin{array}{l} c = Initial / Starting\ Value \\ Plumber: call - out\ charge \end{array}}$

10) Area of a Triangle:

$\frac{1}{2}|x_1 y_2 - x_2 y_1|$ $\boxed{One\ point\ must\ be\ (0,0),\ if\ not\ use\ Translation!}$

1) Equation of a Circle:

(i) $x^2+y^2=r^2$ $\quad Centre(0,0)$

(ii) $(x-h)^2+(y-k)^2=r^2$ $\quad Need:\ Centre(h,k)\ \&\ Radius, r$

2) Point: On, Inside or Outside a Circle:

$Sub\ Point(x,y)\ into\ Equation$

$If\ answer = r^2 \rightarrow On$
$< r^2 \rightarrow Inside$
$> r^2 \rightarrow Outside$

3) Point(s) of Intersection with the Axes:

$x-axis: y=0$
$y-axis: x=0$

Use to draw a Circle!
$Need:\ Centre\ \&\ Point\ On\ Circle.$

4) Endpoints of a Diameter:

(*i*) $Centre = Midpoint\ of\ Diameter$

(*ii*) $Radius = Distance\ from\ the\ centre\ to\ any\ point\ on\ Circle$

(*iii*) $Equation = Need:\ Centre(h,k)\ \&\ Radius, r$

5) Point(s) of Intersection between a Line and a Circle:

$Use: Simultaneous\ Equations!$

$One\ Point:\ Line = Tangent$
$Two\ Points:\ Line = Secant$

6) Properties of Circles:

(*i*) $Tangent = Line\ that\ touches\ circle\ at\ one\ point.$
(*ii*) $Radius \perp Tangent.$
(*iii*) $If\ Radius \perp Cord,\ then\ the\ Radius\ Bisects\ that\ Cord,$
$i.e.,\ cuts\ the\ cord\ in\ half.$
(*iv*) $If\ a\ circle\ passes\ through\ the\ points\ of\ a\ Right\text{-}angled\ Triangle:$
$the\ Diameter\ is\ always\ the\ side\ opposite\ the\ 90°\ Angle.$

7) Equation of a Tangent to a Circle, at a Point:

$y-y_1=m(x-x_1)$ $\quad Need:\ Slope = m\ \&\ Point = (x_1, y_1)$

(*i*) *Find the Centre,*
(*ii*) *Find the slope of the Radius,*
(*iii*) *Find the slope of the Tangent* &
(*iv*) *Find the Equation of the Tangent.*

Or use the formula: $(x-h)(x_1-h)+(y-k)(y_1-k)=r^2$

Trigonometry

A) Arc Length: $\boxed{Need: \ Angle \ \theta°, \ Radius = r \ and \ \pi}$

$$Minor / Shorter \ Arc \ Length = \left(\frac{\theta^{\circ}}{360°}\right) 2\pi r \quad Pg.9 \ \ tables$$

B) Area of a Sector: $\boxed{Need: \ Angle \ \theta°, \ Radius = r \ and \ \pi}$

$$Sector \ Area = \left(\frac{\theta^{\circ}}{360°}\right) \pi r^2 \quad Pg.9 \ \ tables$$

C) Rules for Right-Angled Triangles:

(i) *All three angles add to give* $180°$.

(ii) *Label Sides*: *Opposite*(a) = *opposite the Angle,* $A°$ *in the Q.*
Hypotenuse(c) = *opposite the Right Angle,* (*Longest Side*).
Adjacent(b) = *in between the two angles.*

(*iii*) *Ratios of the Sides*: $\boxed{[SOH, \ CAH, \ TOA]}$

$$\boxed{sinA = \frac{Opp}{Hyp}, \quad cosA = \frac{Adj}{Hyp}, \quad \tan A = \frac{Opp}{Adj}} \quad \boxed{\sin A = \frac{a}{c}, \ \cos A = \frac{b}{c}, \ \tan A = \frac{a}{b} \quad pg.16}$$

***Use to find a Side*: *Must have an Angle and a Side*!
***Use to find an Angle*: *Must have two Sides*!

(*iv*) *Pythagoras Theorem*: $\boxed{H^2 = O^2 + A^2}$ $\boxed{c^2 = a^2 + b^2 \quad pg.16}$
***Use to find the third Side*: *Must have the other two Sides*!

(*v*) Area of a Triangle: $\boxed{\frac{1}{2} base \times \perp height}$

D) Rules for Non Right-Angled Triangles :

(i) *All three angles add to give* $180°$.

(*ii*) *Label Angles*: A, B, C *and Label the Opposite Sides*: a, b, c.

(*iii*) *Area of a Triangle*: $\frac{1}{2}ab\sin C$ *Pg*.9 & 16 *tables.*

** *Must have two sides and the angle in between*!

** *Call the Angle C*.

(*iv*) *Cosine Rule*: $a^2 = b^2 + c^2 - 2bcCosA$ *Pg*.16 *tables*

** *I use*: $c^2 = a^2 + b^2 - 2abCosC$, *Always call the Angle C*

To find a Side: *Must have two sides and the angle in between*!

To find an Angle: *Must have all three sides.*

(*v*) *Sine Rule*: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

To find an Angle or a Side: *Must have any Angle and its opposite side*

** *Don't forget your Compass directions*!

** *Know how to use your Calculator, e.g., when looking for an Angle*:

[Shift], [sin] / [cos] / [tan], [□/□], [=], [D°M'S"], [=] *Angle*

Probability

A) Arrangements: *Shift*, x^{-1} *for Factorial Notation,* $x!$

A selection of a number of items in a specific ORDER

**All items are placed into a certain position.*

**Each position has a number of choices.*

**Always start with the position that is most restricted.*

**Do not repeat a choice unless the Q states so.*

Q. In how many different ways can 5 *items be arranged,*
if there are no reptitions and no restrictions.

$\rightarrow 5! = 5\times 4\times 3\times 2\times 1 = 120.$

**Look out for questions involving: Words, Seating arrangements, Codes, Numbers.*

B) Combinations: *Shift*, ÷ *for nCr* $\binom{n}{r}$

A selection of a small number of items out of a bigger group of items, at random / in any order.

Q. In how many different ways can a team of five players be chosen / selected out of a group of 10 *people, if there no restrictions.*

$\rightarrow \binom{10}{5} = \frac{10\times 9\times 8\times 7\times 6}{5\times 4\times 3\times 2\times 1} = 252$

Look out for questions involving Selecting: Teams, Groups, Bands, Councils, Committees!

C) **Probability**:

Law 1: $P(\textit{Event Occuring}) = \dfrac{\textit{Number of DESIRABLE outcomes}}{\textit{Number of POSSIBLE outcomes}}$

Law 2: *All answers are between* 1 *and* 0 (*success and failure*).

Law 3: $P(A \textit{ And } B) = P(A) \times P(B)$ $\boxed{AND = \times}$

Fundamental Principle of Counting:
If one task can be done in X different way AND following this
another task can be done in Y different ways,
then the first task followed by the second task can be done in $(X)(Y)$ *different ways*

Law 4 (I): $P(A \textit{ Or } B) = P(A) + P(B)$

$\boxed{OR = +}$ *Mutually Exclusive Events - can't happen at same time!*

Law 4 (II): $P(A \textit{ Or } B) = P(A) + P(B) - P(A \textit{ And } B)$

NOT *Mutually Exclusive Events - can happen at same time!*

Law 5: $P(\textit{Success}) + P(\textit{Failure}) = 1$

$P(\textit{Event occurs at least once}) = 1 - P(\textit{Event Never Occurs})$

Sum of all the probabilities of all possible outcomes of a trial $= 1$

Relative Frequency / Experimental Probability: $\dfrac{\textit{Number of successful trials}}{\textit{Number of Total trials}}$

Expected Frequency: *Number of Trials* $\times$ Relative Frequency

Expected Value (*Average Outcome*): $\boxed{\sum [X \bullet P(X)]}$

Multiply the outcome by the probability for that outcome and add all

$= 0$ *game / bet is fair* (*equally likely to win or lose in the long run*)
> 0 expect *to win in the long run*
< 0 expect *to lose in the long run*

Q. Find the Probability *that...*

D) Terms/Definitions:

A Trial: *The act of doing something*

An Outcome: *The result of a trial*

Outcome / Sample Space: *Listing all the outcomes of a trial*

i) *Systematic Listing* $\{H, T\}$
ii) *Venn Diagram*
iii) *Tree Diagram*
iv) *Two-Way Table*

Equally Likely Outcomes: *The outcomes have the same chance of happening* (*fair / unbias*)

Event: *The desired outcome*

Combined Events: *When two or more trials occur and their outcomes are combined* (*Heads and* 6)

Independent Events: *The outcome of one trial doesn't affect the outcome of another trial*

Dependent Events: *The outcome of one trial affects the outcome of another trial*

Bernoulli Trials: *Trials with only two possible outcomes* (*Success or Failure*)

Statistics

A) Median, Mode, Mean μ_x (Central Tendency/Average) & Standard Deviation σ_x :

List of Numbers:

Median = Middle number $\left(\text{Rank} = \text{Put the numbers in ascending order}\right)$.

Mode = The number that occurs most.

Mean = Average = $\mu = \dfrac{\sum x}{n}$ *Pg.33 tables.*

Standard Deviation = How closely linked a group of numbers is to the Mean.

$\sigma = \sqrt{\dfrac{\sum (x-\mu)^2}{n}}$ *Pg.33 tables.*

Frequency tables:

Median = $\boxed{\text{Position} = \dfrac{1}{2}(n+1)}$.

Mode = The number on the top of a table with the highest frequency on the bottom.

Mean = Average = $\mu = \dfrac{\sum fx}{\sum f}$ *Pg.33 tables.*

Standard Deviation = How closely linked a group of numbers is to the Mean.

$\sigma = \sqrt{\dfrac{\sum f(x-\mu)^2}{\sum f}}$ *Pg.33 tables.*

**For Grouped Frequency Tables, don't forget to get the mid – interval values!*

$3M's$:

An Average: *A single typical value used to represent the data values of a data set.*

The mean average can be distorted by Outliers (*Extreme Values*) *in a distribution set.*

B) Measures of Spread:

Range: *Max - Min values in a distribution set*

Interquartile Range: *Upper Quartile*(Q_3) – *Lower Quartile*(Q_1)

$Q_3 = \frac{3}{4}(n+1)$ & $Q_1 = \frac{1}{4}(n+1)$

A low range or interquartile range infers that there is little to no variation or similar data values, consistency in data values of the data set.

Standard Deviation: *How far or how close a group of data values in a set are to the mean average*

C) Normal Distribution & The Empirical Rule:

How the data values in a set are distributed around the mean.

The majority of data values lie close to the mean value, as the data values either increase or decrease in size, the proportion of these data values normally decrease as they deviate away from the mean value.

This gives rise to a Symmetrical / Bell-shaped curve or Normal Distribution

The Empirical Rule:
68% *of data values in a population are within the range*: $[\mu - 1\sigma, \mu + 1\sigma]$
95% *of data values in a population are within the range*: $[\mu - 2\sigma, \mu + 2\sigma]$
99.7% *of data values in a population are within the range*: $[\mu - 3\sigma, \mu + 3\sigma]$

The mean average is affected by outliers and can cause Skewness (*asymmetry / distortion*) *to the shape of the distribution.*

If the mean is lower than the median, then the data is said to be skewed to the Left or Negatively skewed

If the mean is higher than the median, then the data is said to be skewed to the Right or Positively skewed

When the Mean, Mode and Median are the same value, then the data is normally distributed.

The Mode will always give rise to the height of a graph.

*Uni*mod*al*: *data set with one* mod*e*
*Bi*mod*al*: *data set with two* mod*es*
*Multi*mod*al*: *data set with many* mod*es*

D) Graphing and Displaying Data:

Types of graphs used to display Data to the public:

1. *Bar Chart*:

Displays Discrete Numerical Data and has gaps between the boxes/bars.
Can be horizontal or vertical.
Draw from a Frequency table.

2. *Histogram*:

Displays Continuous Numerical Data and has no gaps between the boxes/bars.
Draw from a Grouped Frequency table.
The ranges of values are listed at the bottom and these are called 'classes'.
Taller bars represent the classes with greater frequencies

3. *Pie Chart*:

Displays parts of a whole and each section or slice is a data percentage.

4. *Line Plot*:

Displays small amounts of discrete numerical data as • or ×, like a bar chart.

5. *Stem & Leaf Plot*:

Divides Numerical data into 2 pieces and provides a way of listing all values of data in compact form.
Usually, the value with the highest place is represented by the Stem (number in the 'hundreds/tens' position) and the Leaves represent the number in the 'ones' position.
The values must be ranked.
A Key must be provided.

6. *Scatter Plot*:

Used to investigate relationships between Two sets of data,
data that can be paired / Bivariate data.
It is important to have boths sets of data in order.

Shows if there is Correlation (Linear Relationship) or a Link between the data sets,
in relation to the scatter points on the graph.

If the points are increasing from left to right, you have a positive correlation
(*Daily hours of intense sun V Sales in suncream*), *which can be strong or weak,*
depending on the closeness of the points and if they tend to make a straight line.

If the points are decreasing from left to right, you have a negative correlation
(*Hours of Cardio Exercise V Body mass*).
If the points are really spread out, you would say there is no correlation (*Height V I.Q.*).

Correlation Coefficient, r:

Is a number $-1 < r < 1$ *that describes the strength and direction of the correlation.*
$r = 1$ *indicates perfect positive correlation*
$r = -1$ *indicates perfect negative correlation*
$r = 0$ *no correlation*

D) Terms/Definitions:

Data: Facts or statistics collected together for reference or analysis.

Primary Data: Data you collect yourself, maybe by means of Survey/Questionnaires, Designed/controlled experiments, Observational Studies.

Secondary Data: Data already collected by someone else in newspapers, books and the internet.

Univariate Data: One variable being studied at a time, eg. Age.

Bivariate Data: Two variables being studied at a time, eg. Hair colour & Eye Colour.

Numerical Data: Data counted or measured in Numbers

1. *Discrete: Data that can be counted.*
Individual or exact values,
eg. Number of goals scored in a match.

2. *Continuous: Data that can be measured on some scale*
and can include fractions and decimals, eg. Weight, Height, etc.

Categorical data: Data that is used to describe and can't be counted or measured.

1. *Nominal: data that can be described using words, eg. colours, place names.*
2. *Ordinal: data that can be organised into logical order, eg. position in a race.*

Population: *The entire group being studied*.

Sample: *A small part of a population selected to be studied*.

Simple Random Sample: *A sample that is selected at random from the population, where every member of the population has an equal chance of being selected and the sample is representative of the entire population.*

Census: *A collection of data relating to the population.*

Statistics: *Data gathered from a sample.*

Bias / Unfairness: *Anything that distorts the data taken, mistakes in recording data, outliers, etc.*

Survey: *The most common way of collectin Data.*

1. *Personal Interviews*: *People are asked questions face to face.*
Advantage: *Qusetions can be* exp*lained in* det*ail*.
Disadvantage: *Expensive.*

2. *Telephone Survey*: *People are asked questions over the phone.*
Advantage: *Any questions can be asked*.
Disadvantage: *Easier for people to tell lies.*

3. *Postal Survey*: *Survey sent to an address >*
Advantage: *Cheap.*
Disadvantage: *Poor response rate.*

4. *Online Survey*: *People fill out form online.*
Advantage: *Honest answers given due to anonymity.*
Disadvantage: *Limited to people with* int*ernet and computers.*

D) Designing Questionnaires:

The Questionnaire must be:

Short and Precise
Clear about who it is for, the right group being studied
Clear about the answers needed
Clear about where and how to write the answers

The Questions should be:

Easy to read, with simple language and short closed questions
Provide tick boxes and mutiple choice questions instead of open ended questions
No leading or misleading questions, be clear about what is being asked