The Basic Maths you need are listed below. This file is just a summary

- Rearranging equations.
- Scientific notation.
- Significant figures.
- Trigonometric functions.
- Vectors
- Understanding graphs
- Simultaneous equations.
- Introduction to calculus.

# Rearranging equations.

# Rearranging equation

There is only one thing to remember

**DO THE SAME THING**

**BOTH SIDES**

This will keep the equation balanced

$$a+b=c+d$$

$$a+b-d=c+d-d$$

$$a+b-d=c$$

$$2x + y = 4 \quad \dots (1)$$

$$2x = 4 - y$$

$$x = \frac{4 - y}{2}$$

Rearrange the equation to make v the subject

This means we want to rearrange the equation so it says v =

$$e = \frac{3v + t}{5}$$

x5 x5

$$5e = 3v + t$$

- t - t

$$5e - t = 3v$$

÷3 ÷3

$$\frac{5e - t}{3} = v$$

Our answer should say ... $v = \frac{5e - t}{3}$

- A ***formula*** is an equation that expresses the relationship between two or more related quantities.

- As the equations get harder and longer we have to be more and more careful about what we do first. Always though we are just doing the same thing to both sides of the equation. Whatever that is.

# Solve for e

$$C = \frac{2eAk_1k_2}{d\left(k_1 + k_2\right)}$$

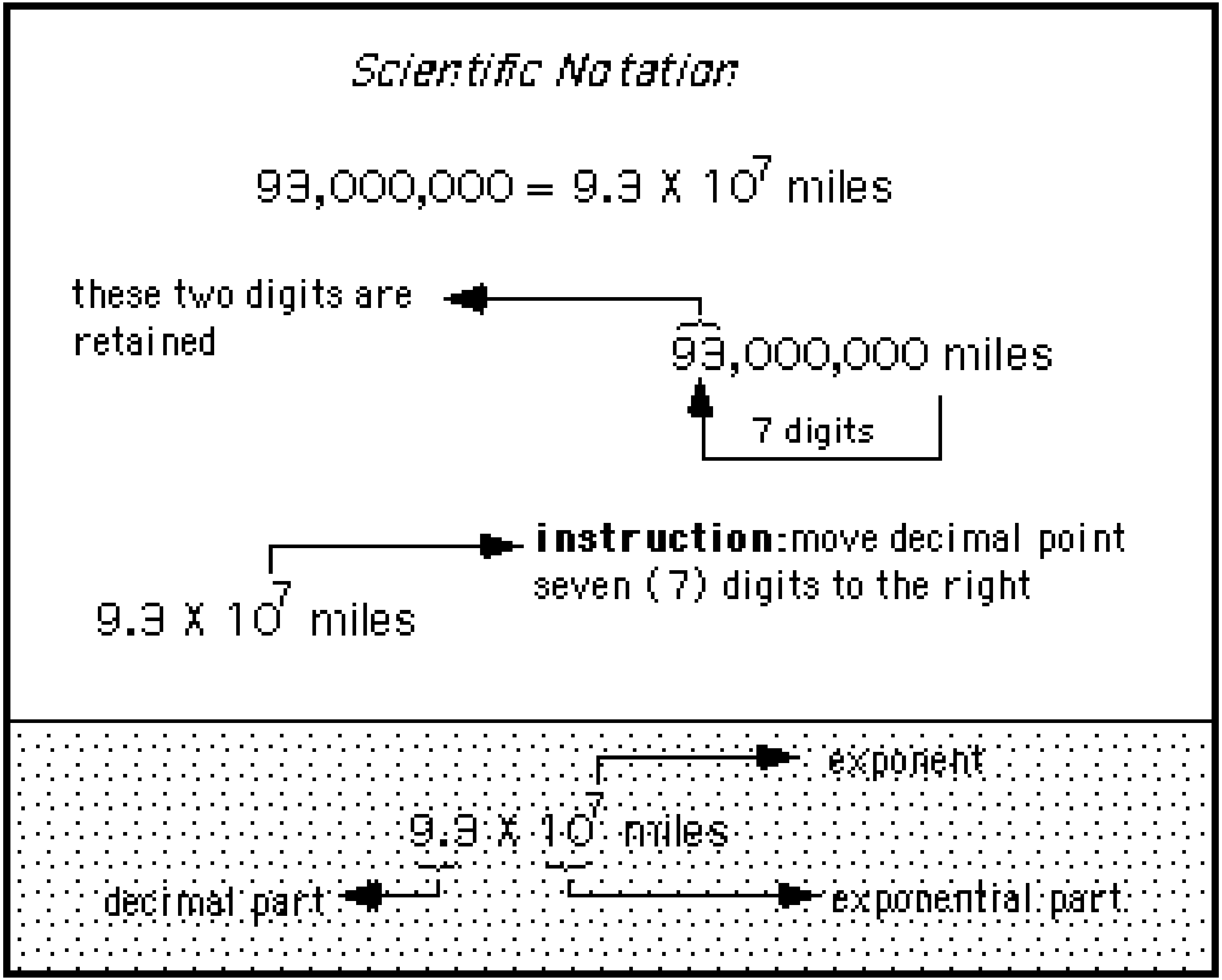
We multiply both sides by $d(k_1 + k_2)$.

$$Cd\left(k_1 + k_2\right) = 2eAk_1k_2$$

Divide both sides by $2Ak_1k_2$.

$$\frac{Cd\left(k_1 + k_2\right)}{2Ak_1k_2} = e$$

# Scientific notation.



Scientific Notation
93,000,000 = 9.3 X 10^7 miles
these two digits are retained
93,000,000 miles
7 digits
9.3 X 10^7 miles
instruction: move decimal point seven (7) digits to the right
exponent
9.3 X 10^7 miles
decimal part
exponential part

# Significant figures.

## Accuracy:

the number of significant digits a number has.

## Precision:

the decimal position of the last significant digit.

When **adding or subtracting approximate** numbers, keep as many decimal places in your answer as contained in the number having the **fewest decimal places.**

When **multiplying** 2 or more approximate numbers, round the result to as many digits as are in the factor having the **fewest significant digits**.

THIS IS FOR **APPROXIMATE** NUMBERS.

Eg

2041.2 has 5 significant figures and 1 decimal place

0.006 has 1 significant figure and 3 decimal places

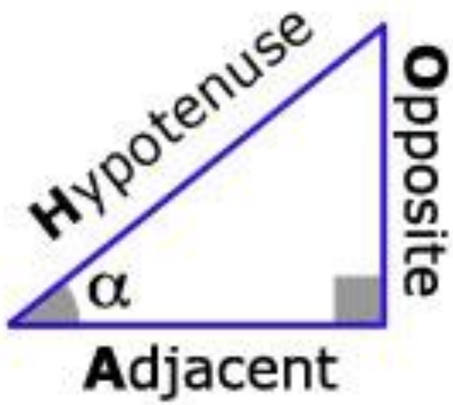
So to add them

**2041.2 + 0.006** = 2041.206 BUT the fewest decimal places is 1 (2041.2) so our answer is quoted to 1 decimal place = **2041.2**

Multiply them

**2041.2 * 0.006** = 12.2472 BUT 0.006 has only **1** significant digit so the answer is = **10**

# Trigonometric functions.




$$\text{sine } \alpha = \frac{\textbf{O}\text{pposite}}{\textbf{H}\text{ypotenuse}}$$

$$\text{cosine } \alpha = \frac{\textbf{A}\text{djacent}}{\textbf{H}\text{ypotenuse}}$$

$$\text{tangent } \alpha = \frac{\textbf{O}\text{pposite}}{\textbf{A}\text{djacent}}$$

SOH CAH TOA

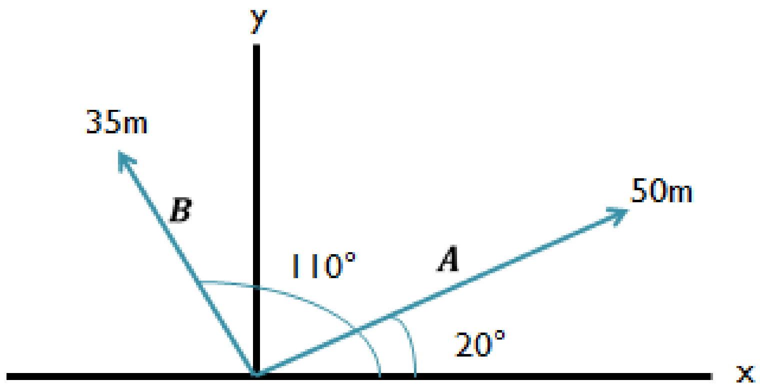
# Vectors

1. Resolve the vectors into perpendicular components.
2. Add the x-components of all vectors to get the x-component of the resultant $R_x$
3. Add the y-components of all vectors to get the y-component of the resultant $R_y$
4. Find the magnitude of the resultant

$$R = \sqrt{(R_x)^2 + \left(R_y\right)^2}$$

5. Find the direction of the resultant

$$\theta = \tan^{-1}\frac{R_y}{R_x}$$




- **Resolve into x and y**
- **Add all x, add all y**
- **Find the resultant**
- **Find the angle**

| | X-Components: | Y-Components: |
|---|---|---|
| For Vector A: | 50 cos 20° = 46.98 (2dp) | 50 sin 20° = 17.10 (2dp) |
| For Vector B: | 35 cos 110° = -11.97 (2dp) | 35 sin 110° = 32.89 (2dp) |
| **Total** | **= 35.01** | **= 49.99** |

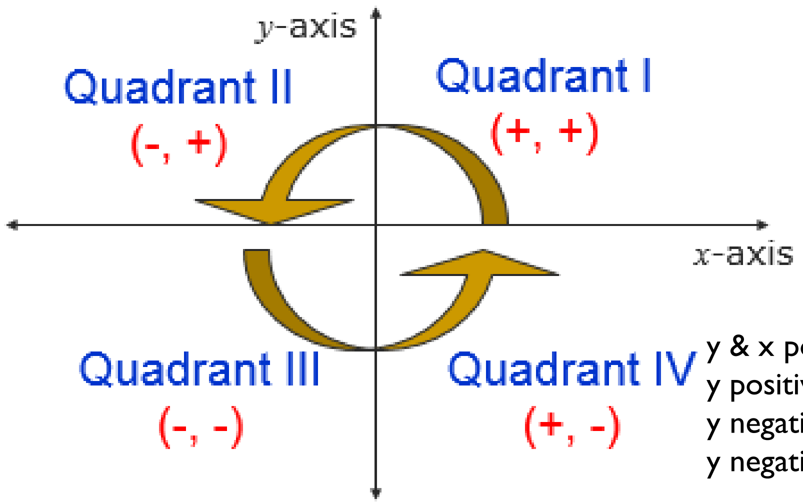
We can now solve for R and θ, using our formulae.

$$R = \sqrt{x^2 + y^2} = \sqrt{35.01^2 + 49.99^2} = 61.03\ metres$$

$$\theta = Tan^{-1}\left(\frac{y}{x}\right) = \left(\frac{49.99}{35.01}\right) = 54.99^\circ$$

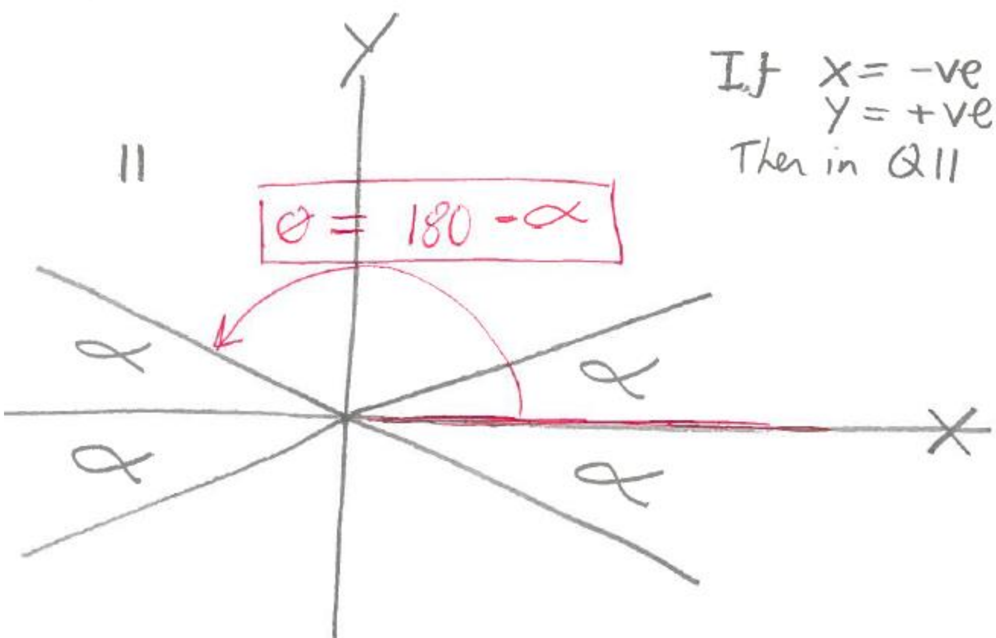
**So our 2 vectors are resolved for the resultant vector $\overrightarrow{R}$**

# HOW TO FIND THE DIRECTION.
(positive angle from positive x axis)
If not in quadrant I or IV




$$\alpha = tan^{-1}\left(\frac{|y|}{|x|}\right)$$

y & x positive = Q1
y positive, x negative Q2
y negative, x negative Q3
y negative, x positive Q4




$\theta = \alpha$ (Q I)

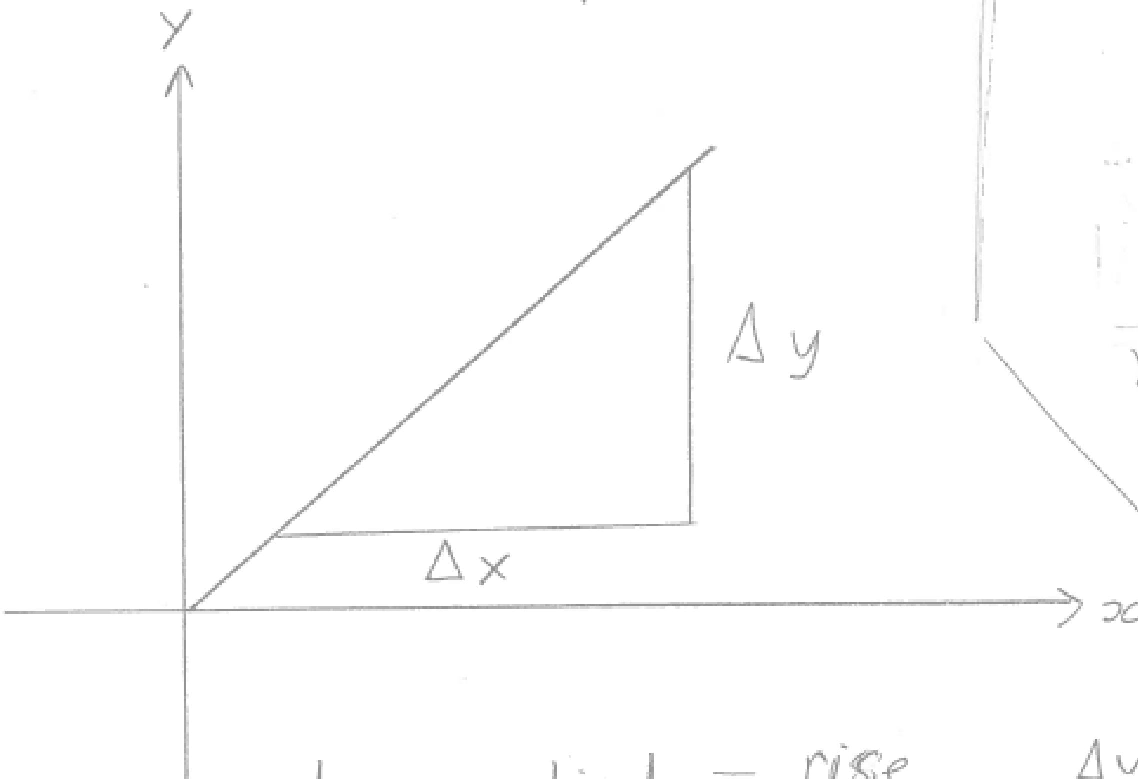
$\theta = 180^\circ - \alpha$ (Q II)

$\theta = 180^\circ + \alpha$ (Q III)

$\theta = 360^\circ - \alpha$ (Q IV)

# Understanding graphs

## Graphs




$$\text{slope} = \text{gradient} = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x}$$

If $y$ = velocity, $x$ = time: $\text{slope} = \frac{\Delta v}{\Delta t} = \text{acceleration}$

From equations to graphs

If $a = \frac{\Delta v}{\Delta t}$

I know if I plot $v$ against $t$


then the slope is the acceleratio

# Simultaneous equations.

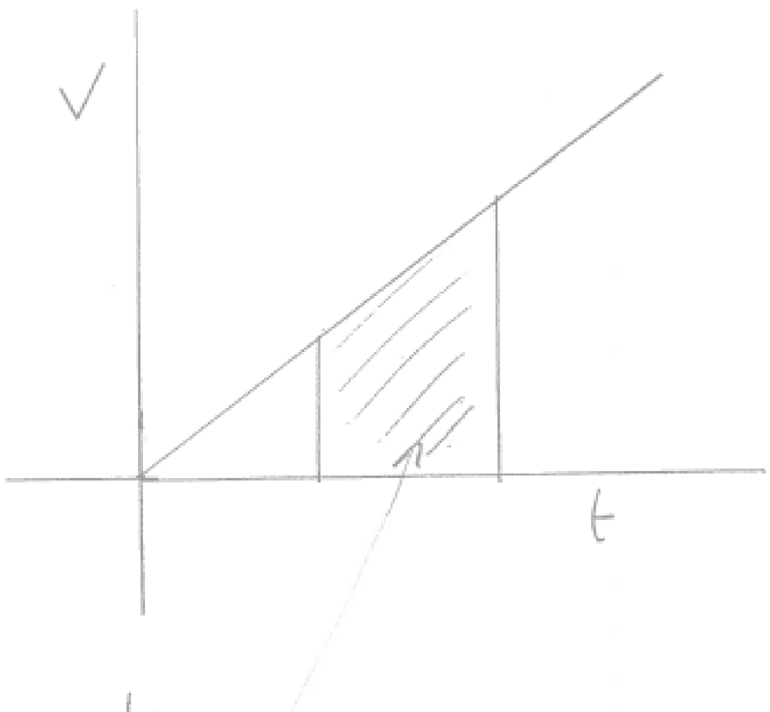
# 1) Solve the system using substitution

$$x + y = 5$$
$$y = 3 + x$$

| | |
|---|---|
| **Step 1: Solve an equation for one variable.** | The second equation is already solved for y! |
| **Step 2: Substitute** | $x + y = 5$<br>$x + (3 + x) = 5$ |
| **Step 3: Solve the equation.** | $2x + 3 = 5$<br>$2x = 2$<br>$x = 1$ |

# Introduction to calculus.

# What is calculus?




Integration finds the area

$$x = \int V \, dt$$

**Differentiation** finds the slope

$$V = \frac{\Delta x}{\Delta t}$$

Instantaneous

$$V = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}$$

$$= \frac{dx}{dt}$$

With calculus you do not have to measure gradients and areas but can calculate them directly