AS LEVEL MATHS P1

Indices

$a^0 = 1$

$a^{x/y} = \sqrt[y]{a^x}$

eg. $27^{\frac{2}{3}} = (\sqrt[3]{27})^2$

$= 3^2 = \underline{\underline{9}}$

$a^{-1} = \frac{1}{a}$

$\left(\frac{a}{b}\right)^{-x} = \left(\frac{b}{a}\right)^x$

$a^{-\frac{x}{y}} = \frac{1}{(\sqrt[y]{a})^x}$

Surds

$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

$\sqrt{a} \div \sqrt{b} = \sqrt{\frac{a}{b}}$

$(\sqrt{a})^2 = a$

Rationalise a denominator

$\frac{5}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{2}}{2}$

$\frac{5}{1+\sqrt{2}} \times \frac{1-\sqrt{2}}{1-\sqrt{2}} = \frac{5-5\sqrt{2}}{-1}$

$\boxed{= -5+5\sqrt{2}}$

change sign

Always check with your calculator. BE CAREFUL AND SHOW ALL WORKING

Inequalities

Solve as normal for linear. Always remember the inequality symbol. NOT '='.

Quadratic Inequalities

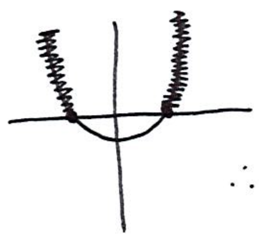
Solve $x^2 + 2x - 5 > 0$

$\therefore$ Cannot be factorised so use the formula.

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

$x = -1 + \sqrt{6} \approx 1.4..$

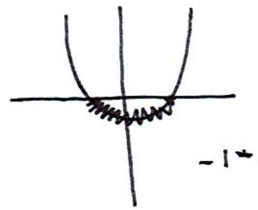
$x = -1 - \sqrt{6} \approx -3.4..$



> 0 ↑ above

$\therefore x > -1+\sqrt{6}$ and $x < -1-\sqrt{6}$

if the question was $x^2 + 2x - 5 < 0$



< 0 ↓

$-1-\sqrt{6} < x < -1+\sqrt{6}$

Always keep answers in exact form

Straight line graphs

gradient $= \frac{y_2 - y_1}{x_2 - x_1}$

$y - y_1 = m(x - x_1)$

Parallel lines have the same gradient.

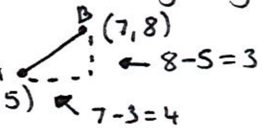
Perpendicular lines have gradients that multiply together to get -1.

$m_1 \times m_2 = -1$

NEGATIVE RECIPROCAL

Finding the length of a line → Use Pythagoras

eg.



$\sqrt{3^2 + 4^2} = 5$ length AB = 5.

Quadratics

Factorise - be careful when the coefficient $\neq 0$

$6x^2 - 13x - 5$

$\times$ -30 $+$ -13

$-3, 10$

$-15, 2 \rightarrow (6x-15)(6x+2)$

$\div 3 \quad \div 2$

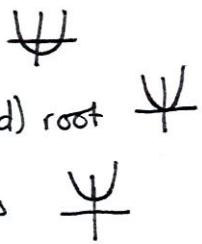
Remember to simplify. $(2x-5)(3x+1)$

Discriminant

$b^2 - 4ac > 0 \quad \therefore$ 2 real roots

$b^2 - 4ac = 0 \quad \therefore$ 1 real (repeated) root

$b^2 - 4ac < 0 \quad \therefore$ No real roots



Simultaneous Equations

When it comes to quadratic simultaneous equations, rearrange the linear equation and make a variable the subject.

eg. $2x + 2y = 7$ ← rearrange.

$x^2 - 4y^2 = 8$

$2x = 7 - 2y$

$x = 3.5 - y$

Sub into ②

$(3.5-y)^2 - 4y^2 = 8$

$\frac{49}{4} - 7y + y^2 - 4y^2 = 8$

$-3y^2 - 7y + \frac{49}{4} = 8$

$3y^2 + 7y - \frac{17}{4} = 0$

$y = \frac{1}{2}$ or $y = -\frac{17}{6}$

sub in.

$2x + 2(\frac{1}{2}) = 7$

$2x = 6$

$x = 3.$

$2x + 2(-\frac{17}{6}) = 7$

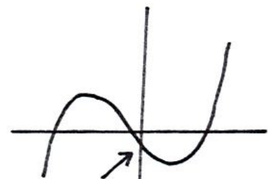
$2x = \frac{38}{3}$

$x = \frac{19}{3}$

when $x = 3, y = \frac{1}{2}$

when $x = \frac{19}{3}, y = -\frac{17}{6}$

Cubic Graphs



multiply all values to get y-intercept

$(x+\underline{3})(x+\underline{1})(x-\underline{4})$

$3 \times 1 \times -4 = \underline{\underline{-12}}$ ← y intercept

Roots are

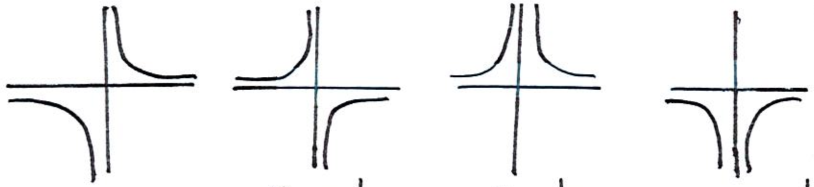
$x+3=0 \quad x=-3$

$x+1=0 \quad x=-1$

$x-4=0 \quad x=4$

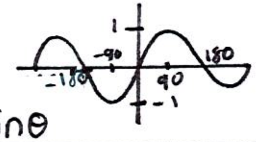
AS LEVEL MATHS P1

Reciprocal Graphs

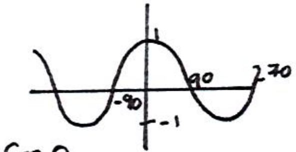


$y = \frac{1}{x}$ $\quad y = -\frac{1}{x}$ $\quad y = \frac{1}{x^2}$ $\quad y = -\frac{1}{x^2}$

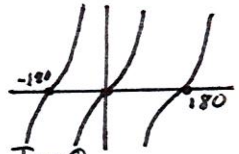
TRIG GRAPHS



Sinθ



Cosθ



Tanθ

Trigonometry

Sine Rule = $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ or $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Cosine Rule $a^2 = b^2 + c^2 - bc\cos A$ or $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

Area of any triangle $= \frac{1}{2} ab\sin C$

*Remember with Sin, there can be two solutions θ and $180 - \theta$

BE CAREFUL LABELLING YOUR TRIANGLES!!

Radians

2π radians $= 360°$ $\quad \pi$ radians $= 180°$

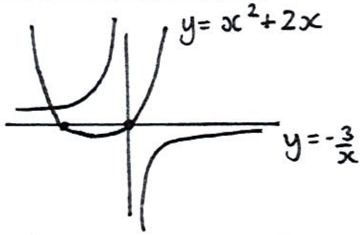
Arc Length $\rightarrow$ $l = r\theta$

Area (sector) $\rightarrow$ $A = \frac{1}{2} r^2 \theta$

Area of a segment in a circle

$A = \frac{1}{2} r^2 (\theta - \sin\theta)$

Intersecting Graphs



As they both '=y' make them equal to each other and show how many solutions

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

$x^3 + 2x^2 = -3$

$x^2(x+2) + 3 = 0$

* YOU MAY NEED TO SKETCH THE GRAPH*

* YOU WOULD NOT NEED TO SOLVE THIS *

Translating Graphs

*INSIDE BRACKET DOES OPPOSITE & AFFECTS X *

*OUTSIDE AFFECTS Y.

$f(x+1)$ ← to the left by 1

$f(x+4)$ ← left by 4

$f(x-3)$ ← right by 3

$f(2x)$ ← divide x-co-ords by 2.

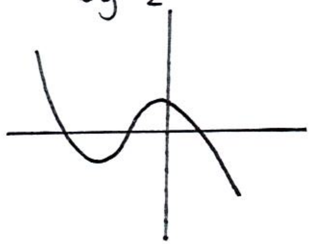
$f(\frac{1}{2}x)$ ← multiply x-co-ords by 2

$f(x) + 1$ ← up by 1

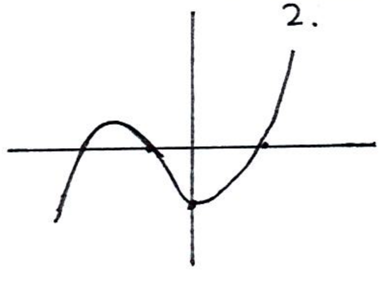
$f(x) - 3$ ← down by 3

$2f(x)$ ← y-coords stretched by 2

$\frac{1}{2}f(x)$ ← y-co-ords divided by 2.



$f(x)$



$-f(x)$

Differentiation

*Remember differentiation is just the gradient of the curve at a certain point. $\rightarrow \frac{dy}{dx}$ or $f'(x)$ is usual notation.

If $y = x^n$, $\frac{dy}{dx} = nx^{n-1}$

If $y = ax^n$ $\frac{dy}{dx} = anx^{n-1}$

Remember to change any difficult expressions into indice notation.

Second order derivatives $\rightarrow$ Rate of change. Differentiate AGAIN!

$\frac{d^2y}{dx^2}$ $\quad$ If $y = 5x^2$ $\quad \frac{dy}{dx} = 10x$ $\quad \frac{d^2y}{dx^2} = \underline{\underline{10}}$

Integration - the opposite to differentiation

$(+C!!!!)$ ← gets you a mark!

If $\frac{dy}{dx} = x^n$ then $y = \frac{1}{n+1} x^{n+1} + c$ $\quad n \neq -1$

$\int x^n \, dx = \frac{x^{n+1}}{n+1} + c$ $\quad n \neq 1$.