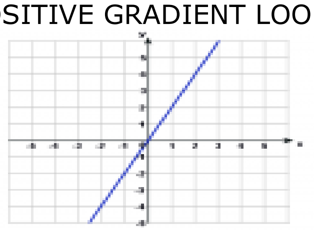
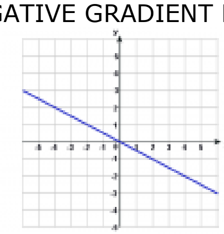
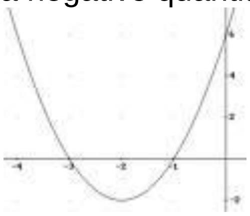
See a bracket – deal with it first!! $5(x + 2) = 15$ $5x + 10 = 15$ $5x = 5$ $x = 1$	To simplify surds like √50, you can split a surd into its factors When splitting, **look for square numbers** $\sqrt{50} = \sqrt{25} \times \sqrt{2} = 5\sqrt{2}$ $\sqrt{98} = \sqrt{49} \times \sqrt{2} = 7\sqrt{2}$ $\sqrt{50} + \sqrt{98} = 5\sqrt{2} + 7\sqrt{2} = 12\sqrt{2}$
If a sequence is First term – 2x3 Second term – 3 x 4 Third term – 4x5 Fourth term = 5x6 LOOK FOR A PATTERN!! Then nth term = $(n+1)(n+2)$	To find a % increase, you must do **% increase = increase/original x 100** e.g. To increase from 7 to 12 % increase = 5/ 7 x 100 = 71%
To find equation of a straight line use $y = mx + c$ m = gradient c = y intercept	To increase by 5%, multiply by 1.05 To decrease by 17% multiply by 0.83
If a surd is on the bottom of a fraction, get rid of it!! If a surd is on the bottom such as √37, then multiply top and bottom by √37 $\frac{7}{\sqrt{5}} = \frac{7\sqrt{5}}{5}$	If given that after a 22% decrease something costs £5 then we know 78%=£5, then we find 1%= 6.41p and then 100% to get original price = £6.41

Difference of two squares $x^2 - 25 = (x+5)(x-5)$ $4x^2 - 25 = (2x+5)(2x-5)$	Difference of two squares $53^2 - 47^2 = (53+47)(53-47) = 600$ $95^2 - 5^2 = (95+5)(95-5) = 9000$
Solve inequalities like equations but remember the sign at the end! Only change sign if multiplying/dividing by a negative!	When substituting follow the laws of BIDMAS ie Brackets Indices (powers) Division/ Multiplication Addition/ Subtraction ½ y^2 when y = 4 is ½ of 4^2= ½ of 16 = 4
To rationalise a denominator, multiply top and bottom by the surd on the bottom! $\frac{3}{\sqrt{5}} = \frac{3\sqrt{5}}{\sqrt{5}\sqrt{5}} = \frac{3\sqrt{5}}{5}$	A negative power means 1 over what it would be if it was positive! A posh word for one over is reciprocal. $2^{-2} = \frac{1}{4}$ $5^{-3} = \frac{1}{125}$
When we raise a power to a power, multiply the powers! $(x^2)^3 = x^6$ If number inside, put that to power outside also! $(3x^4)^2 = 9x^8$	Power ½ means square root Power $\frac{1}{3}$ means cube root
You can't add surds like this: $\sqrt{2} + \sqrt{3} = \sqrt{5}$ Only add if they're the same: $\sqrt{5} + \sqrt{5} = 2\sqrt{5}$	Power $\frac{2}{3}$ means cube root then square Power ¾ means do fourth root then cube

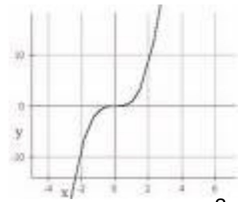
To add/ subtract fractions, get a common denominator $\frac{3}{5}+\frac{7}{15}=\frac{9}{15}+\frac{7}{15}=\frac{16}{15}=1\frac{1}{15}$ $\frac{3}{5}-\frac{7}{15}=\frac{9}{15}-\frac{7}{15}=\frac{2}{15}$	Before calculating with fractions turn any mixed fraction into an improper one! $1\frac{3}{5}\div\frac{2}{7}=\frac{8}{5}\times\frac{7}{2}=\frac{56}{10}=5\frac{6}{10}=5\frac{3}{5}$
If using quadratic formula beware of negatives!	Never use factorisation or quadratic formula to solve until what you want to solve equals zero!
Solve $x^2+y^2=10, x+y=4$ But y= 4-x so substitute linear into quadratic $x^2+(4-x)^2=10$ $x^2+16-8x+x^2=10$ $2x^2-8x+6=0$ $x^2-4x+3=0$ $(x-1)(x-3)=0$ $x=1,3 y=3,1$	IDENTITY – $\equiv$ 3 lines EXPRESSION – no equality sign FORMULA – more than one unknown, would need information about at least one variable to find others, EQUATION – one unknown that can be solved
If a line has gradient 2, its perpendicular has gradient – ½ If a line has gradient $-\frac{1}{4}$, its perpendicular has gradient 4 **The gradient product of two perpendicular lines is -1**	 y = 2^x looks like this, as does y = anything to the power x DRAW IT ACCURATELY BY PLOTTING POINTS!!

When working with algebra use brackets to stop silly mistakes Always factorise or cancel when you can!!	On a number line a filled in circle means $\geq$ or $\leq$ On a number line an open circle means $>$ or $<$
Compound interest is accumulated interest. If a bank account has £1000 and interest is 9% then after 5 years the account will have 1000x1.09x 1.09x1.09x1.09x1.09 or 1000 x 1.09^{5}	When rearranging Use brackets Cancel if you can Factorise if you can Always, when making something the subject, make sure you have it alone on one side only. To do this, make sure you start with the intention of getting everything with your subject in together!!
Gradient = up over across	Standard form- If a number isn't in standard form rewrite first part in standard form as below $0.000000000967\times10^{14} = 9.67\times10^{-10}\times10^{14} = 9.67\times10^{4}$
A LINE WITH POSITIVE GRADIENT LOOKS LIKE THIS!  Eg y=2x+3	A LINE WITH NEGATIVE GRADIENT LOOKS LIKE THIS!  Eg y=-x, y=-4x-5

A QUADRATIC GRAPH SUCH AS y= x^2 is U SHAPED.
If we have a negative quantity of x^2 the graph is



n shaped.



A CUBIC GRAPH SUCH AS y= x^3 is shaped as above.

To multiply fractions, multiply top by top and bottom by bottom

$$\frac{2}{3}\times\frac{4}{5}=\frac{2\times4}{3\times5}=\frac{8}{15}$$

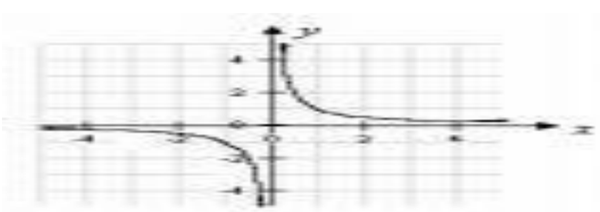
To divide fractions, flip the second fraction and multiply

$$\frac{3}{5}\div\frac{2}{3}=\frac{3}{5}\times\frac{3}{2}=\frac{9}{10}$$

When using mixed fractions, convert into improper fractions first

$$1\frac{3}{4}\div3\frac{2}{7}=\frac{7}{4}\div\frac{23}{7}=\frac{7}{4}\times\frac{7}{23}=\frac{49}{92}$$

A reciprocal graph looks like this eg $\frac{1}{x}$, $\frac{5}{6x}$



Draw it accurately by PLOTTING POINTS!!

With trial and improvement, when you know the answer is between two 1 decimal place values check the middle value to ensure which of the values is closer.

SOLVE $x^2 - 3x=7$ to 1 dp

x	$x^2 - 3x$	comment
4	4	Too low
5	10	Too high
4.5	6.75	Too low
4.6	7.36	Too high
4.55	7.0525	Too high

So answer lies between 4.5 and 4.55 so is 4.5 to 1dp

When we divide powers of the same number or variable we subtract the powers

$$x^8\div x^5=x^3$$

$$6x^7\div18x^9=\frac{1}{3}x^{-2}$$

When we multiply powers of the same number or variable we add the powers

$$x^2\times x^5=x^7$$
$$3y^8\times5y^2=15y^{10}$$

The equation of any straight line can be written in the form y = mx + c m = gradient (increase in y/ increase in x) c = y intercept (the y intercept can be found at the coordinate (0, something))	A number in standard form = a x 10^{b} where a is >1 and <10 To change numbers into standard form change the original number into standard form first $50\times10^{-3}=5\times10\times10^{-3}=5\times10^{-2}$
Parallel lines have the same gradient.	$0.07\times10^{5}=7\times10^{-2}\times10^{5}=7\times10^{3}$ To draw graphs, plot points by choosing the x coordinate and using the rule to work out the y coordinate.
Anything to the power zero is 1! $1^0=1$ $x^0=1$	3 hours 20 minutes is not 3.2 hours It is 3 hours and $\frac{20}{60}$ of an hour which is $3\frac{1}{3}$ hours or 3.33333333333333333333333333 hours
To complete the square halve the coefficient of x and take away the square from the constant $x^2+8x=(x+4)^2-16$ $x^2-6x-16=(x-3)^2-9-16=(x-3)^2-25$	$\frac{50}{0.2}=\frac{500}{2}=250$ $\frac{120}{0.3}=\frac{1200}{3}=400$ $\frac{16}{0.25}=\frac{64}{1}=64$
On the line y = 3x -2 If the x coordinate was 7 the y coordinate would be 3 x 7 – 2 = 21. If the y coordinate was 7, then to find the x coordinate we would have to solve 7 = 3x – 2 and the x coordinate would have to be 3	$3x+2y=9$ $4x+4y=16$ Multiply top equation by 2 to get equal amounts of y top and bottom $6x+4y=18$ $4x+4y=16$ Then take bottom equation from top to get $2x=2$ so $x=1$ Then put x=1 into one of the equations to find y =2

In proof, let any integer be n Then 2n will always be even And 2n+1 will always be odd	**Prove that the sum of the square of an odd number and the square of an even number is 1 more than a multiple of 4** Odd=2n+1 even = 2n Sum of squares = $(2n)^2 + (2n+1)^2 = 4n^2+4n^{2+}4n+1$ $=8n^{2+}4n+1=4(2n^2+n)+1$ As the 4 has been factorised out then the answer is 1 more than a multiple of 4
To solve a quadratic equation, use the following methods in order of preference Factorise Use the quadratic formula Complete the square Before trying to solve, get it equal to zero!	To factorise an expression look for the HIGHEST common factor of each term and put this outside the bracket. Inside the bracket must go what you multiply the highest factor by to get each term. $5x-15=5(x-3)$ $15x^3y^5-6x^2y^3=3x^2y^3(5xy^2-2)$
If there is no common factor when factorising, look for two brackets. $x^2+7x+12=(x+3)(x+4)$ The two numbers in the brackets add to get the middle number in the expression and multiply to get the end number. $x^2-5x+4=(x-1)(x-4)$ $x^2-36=(x-6)(x+6)$	To find the nth term of a linear sequence (goes up by the same amount each time) nth term= **(common difference**) x n **+ zero term** 3,8,13,18 nth term = 5n – 2 90, 74, 58, 42 nth term = -16n + 106
Never cancel until you are multiplying everything top and bottom or until you have factorised! $\frac{x^2+5x}{x^2+6x+5}=\frac{x(x+5)}{(x+1)(x+5)}=\frac{x}{x+1}$	Expand $(\sqrt{7}+3)(\sqrt{5}-4)$ Use FOIL to get $\sqrt{35}-4\sqrt{7}+3\sqrt{5}-12$
Is a triangle with sides $\sqrt{3}+1$, $\sqrt{3}-1$ and $\sqrt{8}$ right angled? Well, does Pythagoras work? $(\sqrt{3}+1)^2=3+2\sqrt{3}+1=4+2\sqrt{3}$ $(\sqrt{3}-1)^2=3-2\sqrt{3}+1=4-2\sqrt{3}$ $(\sqrt{3}+1)^2+(\sqrt{3}-1)^2=8$ so hypotenuse would be $\sqrt{8}$ so it is right angled	Using Completing the square 1: Solving Quadratics $x^2+6x-7=0$ $(x+3)^2-9-7=0$ $(x+3)^2-16=0$ $(x+3)^2=16$ $x+3=\pm4$ $x=-7,1$

Using Completing the square 2: minimum What is minimum of x^2+6x-7? Complete the square to get $(x+3)^2-16$ Then minimum is -16 because the expression above is minimum when square is zero So minimum is -16 when x=-3	In probability, if a question asks for who has the most accurate results then it is always the person who has performed more trials
Before solving a quadratic equation make it equal to zero	$8^{\frac{2}{3}} = 2^2 = 4$ $27^{-\frac{2}{3}} = \frac{1}{27^{\frac{2}{3}}} = \frac{1}{9}$ $(\frac{8}{27})^{\frac{2}{3}} = \frac{8^{\frac{2}{3}}}{27^{\frac{2}{3}}} = \frac{4}{9}$
If in any doubt **Factorise** or use **Pythagoras**	When comparing distributions always comment on the average and spread e.g. Boys marks on average are better but the range is higher so the marks are more spread out; they are less consistent
The gradient product of two perpendicular lines is -1 Give the equation of the perpendicular to y=2x at (0,3) Gradient of perpendicular = $-\frac{1}{2}$ Y intercept = 3 So equation is $y=-\frac{1}{2}x+3$	**Parallel lines have the same gradient** Give the equation of the line passing through (2,6) which is parallel to y=2x-3 Gradient of parallel = 2 So equation is y=2x + something Because it passes through (2,6), when x=2, y=6 S0 6=4 + something so something =2 Equation is y=2x+2
When y is directly proportional to x the rule y = kx exists When y is directly proportional to x^2 the rule $y = kx^2$ exists	When y is inversely proportional to x the rule $y = \frac{k}{x}$ exists. When y is inversely proportional to x^2 the rule $y = \frac{k}{x^2}$ exists.

Example: y is directly proportional to x^2. When x=2, y=8. What is y when x = 7 The rule $y = kx^2$ exists. So 8 = 4k, k=2 When x =7, $y = 2x^2$, y= 2 x 49= 98	Example: y is inversely proportional to x^2. When x=2, y=1. What is y when x = 2? The rule $y = \frac{k}{x^2}$ exists So 1=k/4 so k=4 When x =2, y = 4/x, y= 2.
Turning Recurring decimals into fractions $x = 0.423232323232323$ $100x = 42.32323232323232$ $99x = 41.9$ $x = \frac{41.9}{99} = \frac{419}{990}$	When turning recurring decimals into fractions, Multiply by 10 if one repeating decimal Multiply by 100 if two repeating decimals Multiply by 1000 if three repeating decimals
To find a recurring decimal just divide $\frac{4}{9} = 4 \div 9 = 0.4444444444444$	If a question requires you to solve. but doesn't give an equation, use your initiative Call whatever you start with *x* and work from there
Solve $\frac{3}{x-1} - \frac{2}{x+1} = 1$ $3 - \frac{2(x-1)}{x+1} = x-1$ $3(x+1) - 2(x-1) = (x-1)(x+1)$ $3x + 3 - 2x + 2 = x^2 - 1$ $x^2 - x - 6 = 0$ $(x-3)(x+2) = 0$ $x = -2, 3$	3.7^{05} ON A CALCULATOR MEANS 370000
If a question asks you to put an expression in the form $(x + a)^2 + b$, this means COMPLETE THE SQUARE!	**Reciprocal means 1 over!!** So the reciprocal of 5 is 1/5 The reciprocal of 2/3 is 3/2 (turn the fraction upside down)

If asked for an irrational number use pi or a square root e.g. an irrational number between 5 and 6 is pi – 1 OR the square root of 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36	If a sequence is non linear, it must have something to do with n^2, so take the sequence 1,4,9,16,25 off the original sequence and see what's left So 2,3,6,11, 18 Take off 1,4,9,16,25 to get 1, -1, -3, -5, -7 The nth term of this is 3 –2n So the whole sequence is made up of n^2 –2n + 3
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ remember that you are dividing the whole thing by 2a!!! a= number in front of x^2 b= number in front of x c= constant	Solve $2x^2 - 5x - 6 = 0$ using the quadratic formula. $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-6)}}{2(2)}$ $= \frac{5 \pm \sqrt{25 + 48}}{4}$ $= \frac{5 \pm \sqrt{73}}{4}$ $= \frac{5 \pm 8.544}{4}$ So $x = \frac{5 + 8.544}{4}$ or $x = \frac{5 - 8.544}{4}$ $= \frac{13.544}{4}$ $= \frac{-3.544}{4}$ $= 3.386$ $= -0.886$ $= 3.39$ correct to 2dp $= -0.89$ correct to 2dp
In SHOW THAT questions, Full answers are required- STATE THE OBVIOUS! Don't miss out any steps!!	When estimating, a rule of thumb is to round all quantities to 1 SIGNIFICANT FIGURE. Sometimes 2sf is better but it would be made pretty obvious. e.g. $\frac{39.1}{0.77} \approx \frac{40}{0.8} \approx \frac{400}{8} \approx 50$
Don't get Highest common factor and least common multiple mixed up!! e.g. 72 and 108 HCF = 36 LCM = 216	To write a number as a product of its prime factors, do as below!! 108 = $2^2 \times 3^3$ 72 = $2^3 \times 3^2$

$108 = 2^2 \times 3^3$ $72 = 2^3 \times 3^2$ You can find HCF and LCM using these but IT IS NOT RECOMMENDED. HCF – highest power of all common numbers used $= 2^2 \times 3^2 = 36$ LCM = highest power of all common numbers used $= 2^3 \times 3^3 = 216$	**Graphical inequalities** When testing which side to shade, test a point on the appropriate side of the line before you shade!!
Don't round until the end of a question. Try to use full answers throughout your calculations, then round appropriately at the end!!	**Be careful when adding quantities with standard form** **DO NOT ADD THE POWERS!** **e.g.** $7.5\times10^3 + 8.2\times10^2 = 7500 + 820 = 8320 = 8.32\times10^3$
Simplify $\frac{1}{x}+\frac{3}{2-x}$ Get a common denominator $\frac{2-x}{x(2-x)}+\frac{3x}{x(2-x)}=\frac{2x+2}{2x-x^2}$	**You may be asked to use the quadratic formula without a calculator!!** **Solve** $3x^2+5x-1=0$ **a=3, b = 5, c = -1** **So x =** $\frac{-5\pm\sqrt{5^2-(4\times3\times-1)}}{2\times3}=\frac{-5\pm\sqrt{37}}{6}$
To work out what percentage 230 is of 1460 do $\frac{230}{1460}\times100=15.8\%$	

Upper/Lower bounds example Find max speed of Sue's journey if she travelled 25 miles (2sf) in 2.1 hours (1dp) Max speed = max distance/ min time = 25.5/2.05= 12.4 mph	**Suitable degree of accuracy means** **To same accuracy as quantities in the question OR** **To 3 significant figures**
FACTORISE $6x^2 + 25x - 9$ ac = -54, find two factors of this which add to b These are 27 and -2 Rewrite as $6x^2 + 27x - 2x - 9$ $3x(2x+9) - 1(2x+9)$ Factorise in 2 parts $(3x-1)(2x+9)$	$(\sqrt{5}+3)(\sqrt{5}-3) = 5 - 3\sqrt{5} + 3\sqrt{5} - 9 = -4$ **Notice how multiplying expressions which differ only in the sign in the middle, the answer is RATIONAL!** **So, we can say that** $\frac{1}{\sqrt{5}+3} = \frac{\sqrt{5}-3}{(\sqrt{5}+3)(\sqrt{5}-3)} = \frac{\sqrt{5}-3}{-4} = \frac{3-\sqrt{5}}{4}$

Quadratic Equations

$ax^2 + bx + c$

Solving:

- Factorising
- Formula
- Completing the square
- Drawing a graph

Factorising:

easy…

$x^2 + 7x + 12 = 0$

$(x + 3)(x + 4) = 0$

$x = {}^-3$ or $x = {}^-4$

brackets

… more difficult!

multiply

$\frac{6}{1\times6}$ 2x3

$3x^2 - 5x + 2$

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

$3x(x - 1) - 2(x - 1)$

$(3x - 2)(x - 1)$

The formula:

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

Completing the square:

$x^2 + 4x - 3 = 0$

$(x + 2)^2 - 4 - 3 = 0$

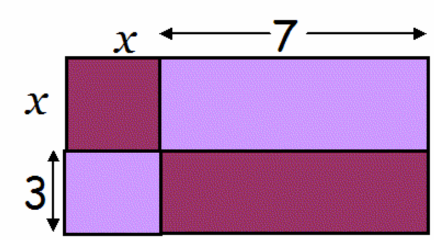
$(x + 2)^2 - 7 = 0$

$x + 2 = \pm\sqrt{7}$

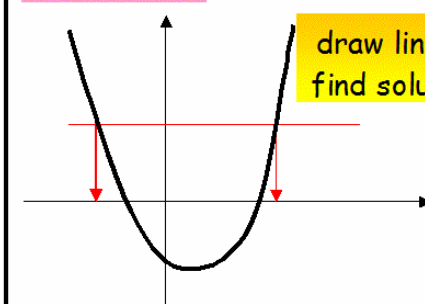
$x = \pm\sqrt{7} - 2$

half of 4x

subtract 2^2



Graphs:



draw lines to find solutions

Parabola – u shaped graph

Difference of Two Squares:

$x^2 - 16$

$(x - 4)(x + 4)$

x squared subtract 4 squared