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Creating VCE Success

Mathematical Methods Teach Yourself Series

Topic 1: Curve Sketching 1 – Linear, Quadratic, Cubic & Quartic Functions

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Curve Sketching 1

In this topic you will learn how to sketch different types of polynomial functions.

Remainder and Factor theorems

As it appears in Unit 1 and 3

Remainder theorem:

If $p(x)$ is divided by $(ax+b)$ then the remainder is given by evaluating $p\left(\frac{-b}{a}\right)$

Factor theorem:

If $p(x)$ is divided by $(ax+b)$ and the remainder by evaluating $p\left(\frac{-b}{a}\right)$ equals 0, $(ax+b)$ is a factor.

Types of questions: Evaluating to see if $(ax+b)$ is a factor of $p(x)$ by finding the remainder.
Finding coefficients of $p(x)$ when given the factor or the remainder.

Equation solving:

Quadratic

$f(x)=ax^2+bx+c$

Factorise and solve

Complete the square and solve

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

Cubic

$f(x)=ax^3+bx^2+cx+d$

Factorise and solve

May have to use polynomial division, quadratic formula or some other method to get solutions

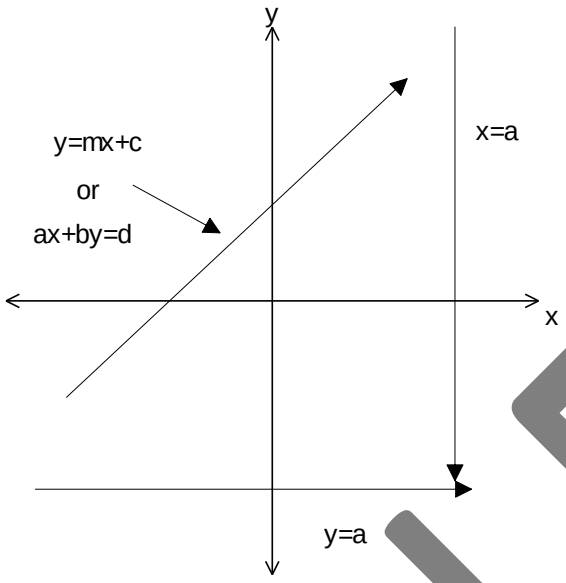
Quartic

Highest power of x is 4.

Factorise and solve

May have to use quadratic formula or some other method to get solutions

Linear Graphs



The following should be familiar:

Linear function can be written as $y = mx + c$ or $ax + by = d$.

The gradient can be calculated by: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Linear functions can be sketched by: gradient-intercept method or intercept/intercept method.

If you know two points that lie on the line or the gradient and one point you can find the equation using:
$y - y_1 = m(x - x_1)$. Remember $m = \dfrac{y_2 - y_1}{x_2 - x_1}$.

The angle that the line makes with the positive direction with the x-axis can be calculated using:
$\tan\theta = m,\ \theta = \tan^{-1}(m)$

The distance between two points = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

The angle, β, which is the angle between two lines, is: $\beta = \theta_2 - \theta_1$, where θ_2, θ_1 are the angles that the two separate lines make with the positive direction with the x-axis.

The midpoint of a straight line that joins (x_1, y_1) and $(x_2, y_2)$is given by: $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$

Simultaneous equations

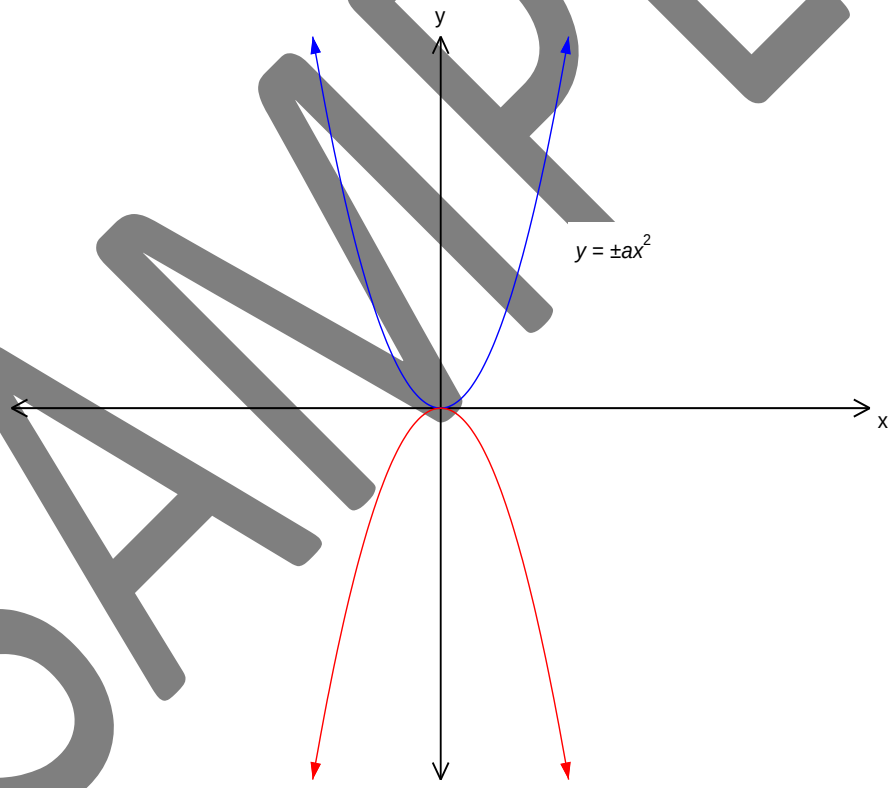
Unique solutions:
Where two equations cross – solve them simultaneously.

Infinite solutions:
Where one line lies on top of another – one equation is a multiple of the other. Set up an equation where the ratios of the coefficients are equal.

No Solutions questions:
Where lines have the same gradient. You can equate the gradients or you can set up a matrix equation and make the determinant equal to zero.

Calculator skills
Solve equations using solve function.
Solve equations using Matrices

Quadratic Graphs:



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Solutions to Review Questions

1.

a. $p(1) = 0$

Use factor theorem

b. $p\left(\frac{3}{2}\right) = 0$

Use factor theorem

2.

a. $k = 6$

Use Factor theorem

$p(3) = 0$

$k - 6 = 0$

b.

$k = -\frac{1}{3}$

Use Factor theorem

$p(-3) = 0$

$-9k - 3 = 0$

3.

a. $(x-3)(x-2)(x+1)$

$p(3) = 0 \Rightarrow x - 3$ is a factor

$\frac{x^3 - 4x^2 + x + 6}{x - 3} = x^2 - x - 2 = (x-2)(x+1)$

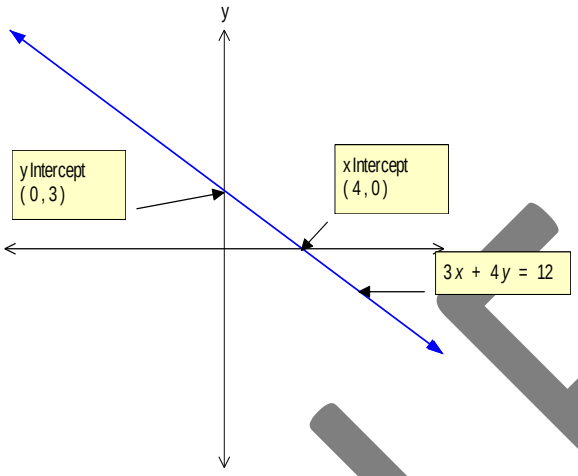
b. $(x+2)(2x-1)(x-3)$

$p(-2) = 0 \Rightarrow x + 2$ is a factor

$\frac{2x^3 - 3x^2 - 11x + 6}{x + 2} = 2x^2 - 7x + 3 = (2x-1)(x-3)$

4.

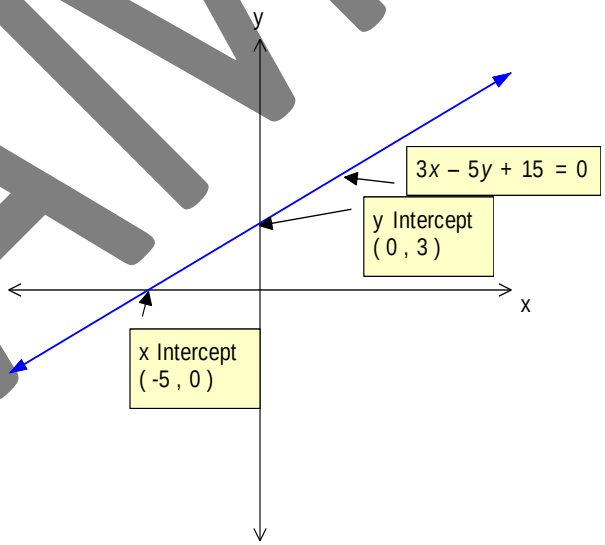
a.



Domain is R
Range is R
Explanation

X intercept, let $y = 0$, solve
Y intercept, let $x = 0$, solve

b.



Domain is R
Range is R
Explanation

X intercept, let $y = 0$, solve

5. Y intercept, let $x = 0$, solve