



ADDITIONAL MATHEMATICS

Elective for Secondary
Three Normal Academic

SYLLABUS AIMS

The Additional Mathematics syllabus aims to enable students who have an aptitude and interest in mathematics to

- Acquire mathematical concepts and skills for higher studies in Mathematics.
- Develop thinking, reasoning and metacognitive skills through mathematical problem solving.
- Connect ideas of mathematics and sciences through application.
- **Appreciate the abstract nature of Mathematics.**

WHAT IS MEANT BY “APTITUDE AND INTEREST”?

- **Strong aptitude in Mathematics**

- You see connections between different mathematics topics.
- You appreciate these connections.
- You want to prove or explain a Mathematics concept.

- **Strong interest in Mathematics**

- When there is a challenging mathematical problem,
 - You keep working on it until it is solved.
 - You read up more about what you don't know.
- You like to know the theory.
- You like spending time understanding a difficult concept.

SYLLABUS CONTENT

Elementary Math: Linear Simultaneous Equations

Question:

Solve the following simultaneous equations:

$$\begin{aligned}5x + y &= 4 \\3x + 2y &= -6\end{aligned}$$

[3]

Answer:

$$\begin{aligned}5x + y &= 4 \text{ ---(1)} \\3x + 2y &= -6 \text{ ---(2)}\end{aligned}$$

From (1): $y = 4 - 5x$ ---(3)

Sub (3) into (2):

$$\begin{aligned}3x + 2(4 - 5x) &= -6 \\3x + 8 - 10x &= -6 \\-7x &= -14 \\x &= 2 \\y &= 4 - 5(2) \\ \therefore y &= -6\end{aligned}$$

Additional Math: Simultaneous Equations between linear and non-linear functions

Question:

Find the coordinates of the points of the intersection when $3x + 2y = 1$ cuts the curve $3x^2 - y^2 = 5x + 3y$. [6]

Answer:

$$3x^2 - y^2 = 5x + 3y \text{ ---(1)}$$

$$3x + 2y = 1$$

$$y = \frac{1-3x}{2} \text{ --- (2)}$$

Sub (2) into (1)

$$\begin{aligned}3x^2 - \left(\frac{1-3x}{2}\right)^2 &= 5x + 3\left(\frac{1-3x}{2}\right) \\3x^2 - \frac{(1-3x)^2}{4} &= 5x + \frac{3(1-3x)}{2} \\12x^2 - (1-3x)^2 &= 20x + 6(1-3x) \\12x^2 - (1-6x+9x^2) &= 20x + 6 - 18x \\12x^2 - 1 + 6x - 9x^2 - 20x - 6 + 18x &= 0 \\3x^2 + 4x - 7 &= 0 \\(3x+7)(x-1) &= 0 \\x = -\frac{7}{3} \text{ or } x = 1 \\y = \frac{1-3\left(-\frac{7}{3}\right)}{2} \text{ or } y = \frac{1-3(1)}{2} \\&= 4 \qquad \qquad \qquad = -1 \\ \therefore x = -\frac{7}{3}, y = 4 \text{ or } x = 1, y = -1\end{aligned}$$

Coordinates of points of intersections = $\left(-\frac{7}{3}, 4\right)$ and $(1, -1)$

SYLLABUS CONTENT

Elementary Math: Quadratic Equation

Question:

Solve $3x^2 - 4x - 2 = 0$, giving your answer correct to 3 significant figures.

Answer:

Using quadratic formula,

$$a = 3, \quad b = -4, \quad c = -2$$

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

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(-2)}}{2(3)}$$

$$x = \frac{4 \pm \sqrt{40}}{6}$$

$$x = 1.72 \text{ or } x = -0.387 \text{ (3 sig fig)}$$

Additional Math: Quadratic Equation (Discriminant)

Question:

Find the range of values of k such that $2x^2 + 5x - k = 0$ has real and distinct roots.

Answer:

To answer this question, we need to understand the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ in greater depth. In order to solve the above equation with two distinct answers, the discriminant $b^2 - 4ac$ in the formula has to be a positive number. Hence,

$$a = 2, \quad b = 5, \quad c = -k$$

We let $b^2 - 4ac > 0$

$$5^2 - 4(2)(-k) > 0$$

$$25 + 8k > 0$$

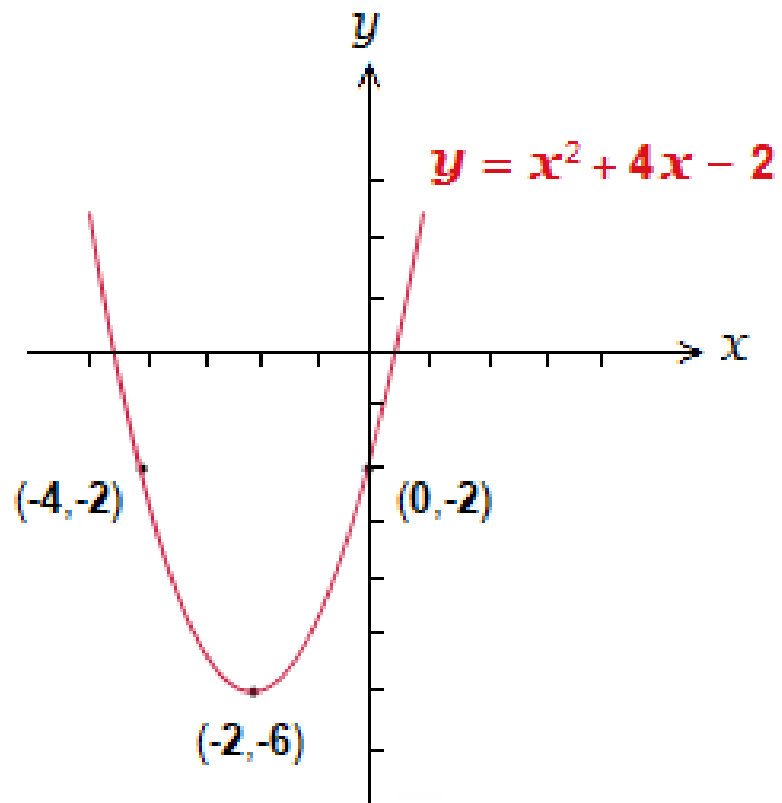
$$8k > -25$$

$$k > -3\frac{1}{8}$$

SYLLABUS CONTENT

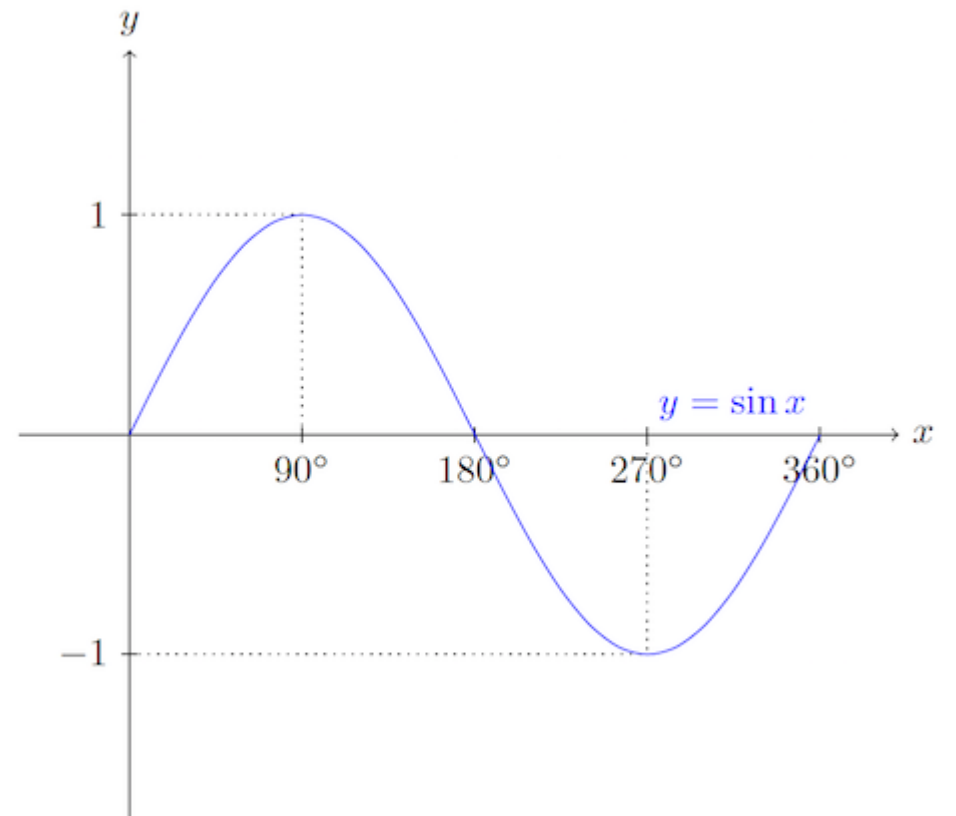
In general, there are three strands

Sketching Quadratic Graphs (Emath)



Mathematics to
the right-angled triangles involving trigonometry.

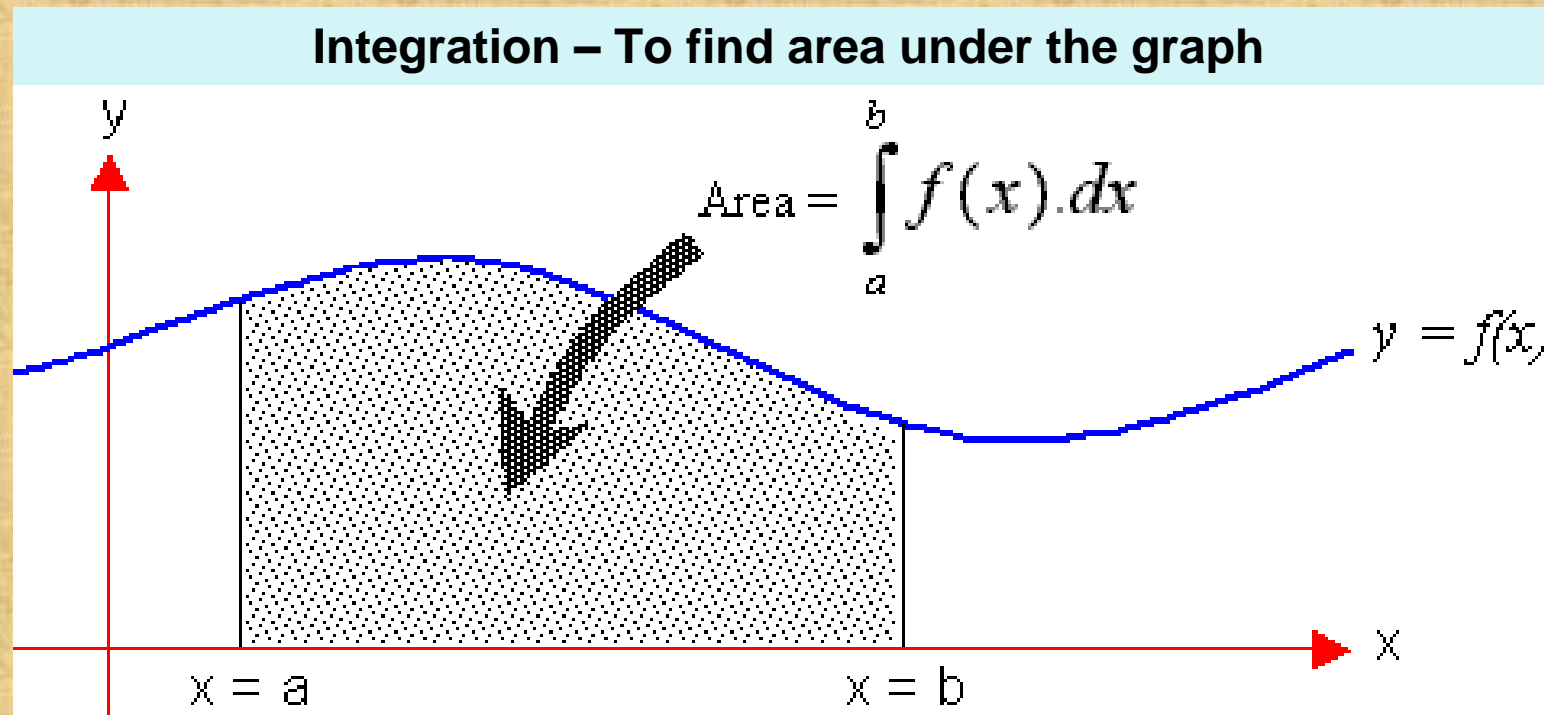
Sketching Trigonometric Graphs (Amath)



SYLLABUS CONTENT

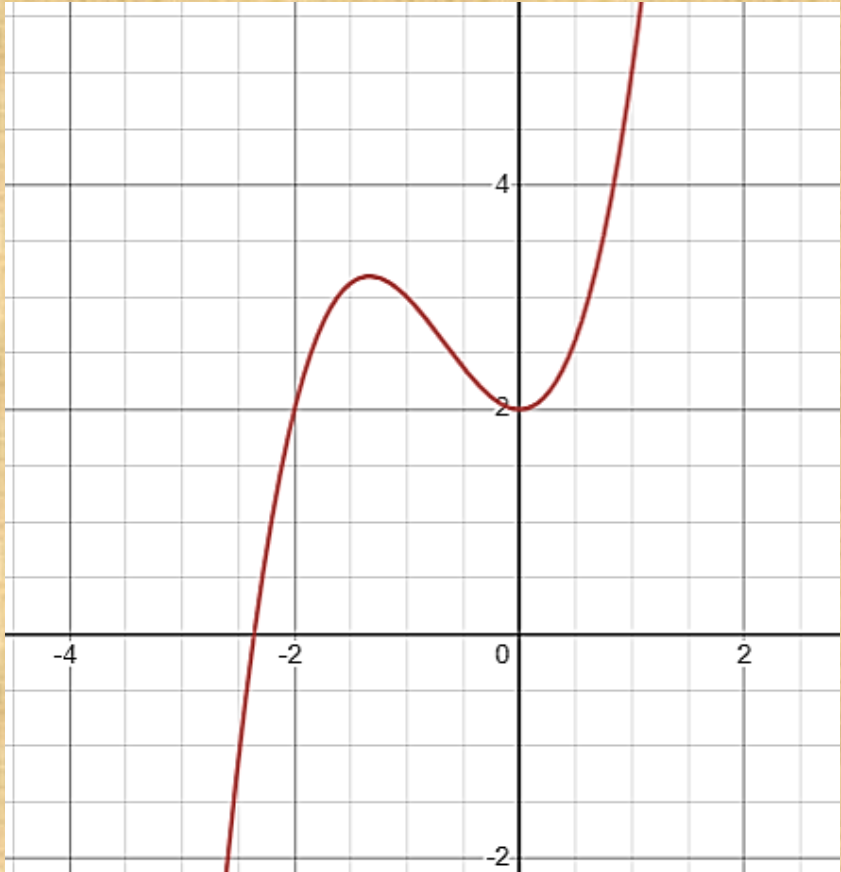
3) Calculus

- **Not** learnt in Elementary Mathematics
- Calculus is a branch of mathematics that helps us understand changes between values that are related by a function.



SYLLABUS CONTENT

Elementary Mathematics (Draw a curve)



Additional Mathematics (Differentiation)

Without drawing the curve

Understand why there are two turning points.

Find the coordinates of the turning points and the nature of these turning points.

Find the coordinates of the points of intersection using Algebra.

TO DO WELL IN ADDITIONAL MATHEMATICS

- You are encouraged to take Additional Mathematics if you have a strong interest in it and is willing to work hard at it.
- You should have a **firm foundation** in Lower Secondary Mathematics, especially Algebra.
 - at least 65% in Mathematics (overall)

FURTHER EDUCATION OPPORTUNITIES

Additional Mathematics is a relevant subject if you intend to

- Study H2 Mathematics in GCE A Level (Junior College).
- Pursue a polytechnic course that requires strong foundation in Mathematics (e.g. Engineering).

Check out the polytechnic course website to find out whether Additional Mathematics is a relevant subject.

Thank you