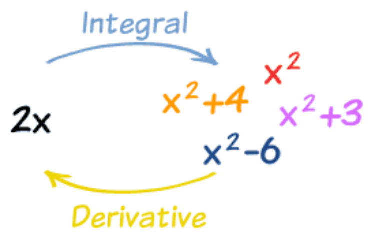
Week 11
Term 1
2024

HAWKER COLLEGE

Engage | Inspire | Achieve

MM3
Integrals

Goals



By the end of this week, you should be able to:

- recognise anti-differentiation as the reverse of differentiation
- use the notation $\int f(x)dx$ for anti-derivatives or indefinite integrals
- establish and use the formula $\int x^n dx = \frac{1}{n+1}x^{n+1} + c$ for $n \neq -1$
- establish and use the formula $\int e^x dx = e^x + c$
- establish and use the formulas $\int \sin x \, dx = -\cos x + c$ and $\int \cos x \, dx = \sin x + c$
- recognise and use linearity of anti-differentiation
- determine indefinite integrals of the form $\int f(ax+b)dx$
- identify families of curves with the same derivative function
- determine $f(x)$, given $f'(x)$and an initial condition $f(a) = b$
- determine displacement given velocity in linear motion problems.

Theoretical Components

Resources:

- *Year 12 Maths Quest Methods* Chapter 9

$f(x)$	$\int f(x)\,dx$
a	$ax + c$
ax^n	$\frac{ax^{n+1}}{n+1} + c$
$(ax+b)^n$	$\frac{(ax+b)^{n+1}}{a(n+1)} + c$
$\frac{1}{x}$	$\log_e \lvert x \rvert + c$
$\frac{1}{ax+b}$	$\frac{1}{a} \log \lvert ax+b \rvert + c$
e^x	$e^x + c$
e^{kx}	$\frac{1}{k} e^{kx} + c$
$\sin(ax)$	$\frac{-1}{a} \cos(ax) + c$
$\cos(ax)$	$\frac{1}{a} \sin(ax) + c$

Read worked examples 1 to 9 on anti-differentiation.
Read worked examples 10 to 12 on integrating special functions.

Practical Components

Complete the following questions. Organise your solutions neatly in your exercise book.

You will require Chapter 9 of Maths Quest Methods (pdf – Google Classroom).

Ex 9A: Antidifferentiation

- Q's 1(f,m,s), 2(c,f), 3, 4, 6, 11(a,e), 12

Ex 9B: Integration of e^x, $\sin x$, and $\cos x$

- Q's 1(a,p) 2, 4, 5, 6(a,j,w), 7(c,e), 12

$$\int [f(x) \pm g(x)]\,dx = \int f(x)\,dx \pm \int g(x)\,dx$$

$$\int kf(x)\,dx = k\int f(x)\,dx$$

$$\int g(x)\,dx = f(x) + c$$

Investigation

See other page.

QFO

Quiz/Forum/Other

Have a nice holidays! 😉

There is a Cambridge Task to complete.

HAWKER COLLEGE
Engage | Inspire | Achieve

Investigation Week 11

Question 1.

Explain the **Fundamental Theorem of Calculus** in your own words. (What does this theorem mean to you, and how do we use it?) Use diagrams to assist in your explanation if you need.

Question 2.

a) Draw the curves $f(x) = x \; and \; g(x) = x^2$ on the same axes and work out the intersection points.

b) Plot the two curves on Desmos, and estimate the area between the intersection points. Each square is about 0.01 $units^2$. Half a square is about 0.005 $units^2$.

c) Find *an* antiderivative (don't add the + C) of the two functions, F(x) and G(x), and then solve each for F(0) and G(0) as well as F(1) and G(1).

d) Evaluate the following: [F(1) – F(0)] – [G(1) – [G(0)]. What do you notice?