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| Integration & Differentiation |
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| What you are given and what you need to know in C4 |

**Formulae for edexcel**

2013/14

Integration & Differentiation

What you are given and what you need to know in C4

# Recap of C3 facts

# Exact Values of trigonometric functions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **x˚ (deg)** | **x˚ (rad)** | **sin** | **cos** | **tan** |
| 0 | 0 | 0 | 1 | 0 |
| 30 |  |  |  |  |
| 45 |  |  |  | 1 |
| 60 |  |  |  | √3 |
| 90 |  | 1 | 0 | - |
| 180 | π | 0 | -1 | 0 |

# Rules and facts

1. Sin2x + cos2x = 1
2. Tan x =
3. Cosec x =
4. Sec x =
5. Cot x = =

# Applying these rules

Dividing (1) by sin2x will give you: 1 + cot2x = cosec2x

Dividing (1) by cos2x will give you: tan2x + 1 = sec2x

Differentiation

**Parametric Equations**

If y = f(t) and x = g(t), then:

**Implicit Differentiation**

When f(x,y) = g(x,y), differentiate implicitly: that is differentiate w.r.t. y and include dy/dx . The solution can simplified where necessary.

***Example: y2 = xy + x + 2***

(Hint: Use the product rule for xy)

**ax**

**Proof of ax**

Start with y = ax

Take logs of both sides ln(y) = ln(ax)

ln(y) = x ln(a)

Differentiate implicitly

Rearrange and substitute for y

Integration

# Rules for Integration

## Integration by substitution

There is no simple rule for integration by substitution, you must follow these steps:

* You’ll be given an integral which is made up of two functions of x.
* Substitute *u* for one of the functions of x to give function which is easier to integrate.
* Next, find , and rewrite it so that dx is on its own.
* Rewrite the original integral in terms of *u* and *du*.
* Integrate and substitute back for *u* at the end.

## Integration by parts\*

When u=f(x) and v=g(x), then:

Choose your u and v functions carefully to make the integral easier.

## Volume of revolution: Cartesian

This describes the volume generated when the curve of y = f(x) from x1 to x2 is rotated 360˚ about the x-axis.

**Volume of revolution: Parametric**

This describes the volume generated when the curve is defined by its parametric form (x(t), y(t)) in the interval (a,b) is rotated 360˚ about the x-axis.

Both equations for the volumes of revolution can be adjusted for rotation about the y-axis by substituting x for y and vice versa.

Standard Integrals you should know:

where n≠1

## Exponential functions

## Other functions

This rule leads to these standard integrals (\*) :

## Using functions and derivatives

Trigonometric Integration

# Basics

Learn these facts and do not confuse them with the rules for differentiation.

# Summary (+ constant)

|  |  |  |
| --- | --- | --- |
| **y=f(x)** |  | **In formula book** |
| Cos x | Sin x |  |
| Sin x | -Cos x |  |
| sec2(kx) | tan (kx) | \* |
| tan(x) |  | \* |
| cot(x) |  | \* |
| sec (x) |  | \* |
| cosec(x) |  | \* |

# Applying these facts

By the chain rule:

Hence:

It follows that:

By the quotient rule:

Hence:

Also: (\*)

Thus: