

FORMULAE LIST

Circle:

The equation $x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle centre $(-g, -f)$ and radius $\sqrt{g^2 + f^2 - c}$.

The equation $(x - a)^2 + (y - b)^2 = r^2$ represents a circle centre (a, b) and radius r .

Scalar Product:

$\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}| |\mathbf{b}| \cos \theta$, where θ is the angle between \mathbf{a} and \mathbf{b}

or $\mathbf{a} \cdot \mathbf{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$ where $\mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$.

Trigonometric formulae:

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$= 2 \cos^2 A - 1$$

$$= 1 - 2 \sin^2 A$$

Table of standard derivatives:

$f(x)$	$f'(x)$
$\sin ax$	$a \cos ax$
$\cos ax$	$-a \sin ax$

Table of standard integrals:

$f(x)$	$\int f(x) dx$
$\sin ax$	$-\frac{1}{a} \cos ax + c$
$\cos ax$	$\frac{1}{a} \sin ax + c$

Unit 2 Practice NAB A

1. For the recurrence relation $u_{n+1} = au_n + b$, it is known that

$$u_0 = 6, \quad u_1 = 12, \quad u_2 = 21.$$

- (a) Find the values of a and b .
 (b) Hence find the value of u_3 .

2. A farmer has 160 hens. Foxes attack the hens and kill 30% of the remaining hens each month.
 At the end of each month the farmer buys 30 new hens to replenish his stock.

- (a) Set up a recurrence relation to show the number of hens present at the start of each month, just after he restocks his farm.
 (b) Find the limit of this sequence and use this to explain what happens in the long run to his initial stock of 160 hens.

3. Find $f'(x)$, given that $f(x) = \frac{x^3 - 6}{x\sqrt{x}}$, $x > 0$.

4. Find the equation of the tangent to the curve $y = 2x^2 - 5x$ at the point where $x = 2$

5. The height, h , of a ball thrown upwards is calculated using the formula

$$h(t) = 30t - 2t^2, \quad \text{where } t \text{ is the time in seconds after the ball is thrown.}$$

- (a) Calculate the rate of change in the height of the ball after 7.5 seconds.
 (b) Explain your answer.

6. A solid cuboid has a surface area of 600 cm^2
 The volume of the cuboid can be represented by the formula:

$$V(x) = 200x - x^3$$

Find the value of x which maximises this volume.

PA	2.1	2.2
4		
3		1
3		
4		
5		
2		1
4	1	

7. Factorise the cubic $x^3 + 2x^2 - 15x - 36$ fully

8. Solve the cubic equation $f(x) = 0$ given the following:

- when $f(x)$ is divided by $x + 1$, the remainder is zero
- when the graph of $y = f(x)$ is drawn, it passes through the point $(-2, 0)$
- $(x - 3)$ is a factor of $f(x)$

9. The graph of the function $f(x) = kx^2 - 12x + 5$ does not touch or cross the x -axis.

What is the range of values for k ?

5		
2		1
2	1	