**12B First Principles**

1. A point A with coordinates (4,16) lies on the curve with equation $y=x^{2}$. At point A the curve has gradient $g$.
2. Show that $g=\lim\_{δx\to 0}(8+δx)$
3. Deduce the value of $g$

**12C General Rules**

1. Find $f^{'}\left(x\right)$ for each of the expressions for $f(x)$ to the right.
2. $f\left(x\right)=x^{6}$
3. $f\left(x\right)=x^{\frac{1}{2}}$
4. $f\left(x\right)=x^{-2}$
5. $f\left(x\right)=x^{2}×x^{3}$
6. $f\left(x\right)=\frac{x}{x^{5}}$
7. $f\left(x\right)=7x^{3}$
8. $f\left(x\right)=-4x^{\frac{1}{2}}$
9. $f\left(x\right)=\sqrt{36x^{3}}$

**12D Multiple terms**

1. Find $\frac{dy}{dx}$ when $y=x^{2}-6x-4$
2. Find the gradient of the curve $y=x^{3}+x^{2}$ when $x=2$
3. Find the gradient of the curve $y=\frac{1}{3}x^{\frac{1}{2}}+4x^{2}$ at the point $\left(1,\frac{13}{3}\right)$

**12E Preparing for Calculus**

1. Find $\frac{dy}{dx}$ when $y=\frac{1}{4\sqrt{x}}$
2. Find the gradient of the curve $y=\frac{x-2}{x^{2}}$at the point (2,0)

**12F Tangents & Normals**

1. Find the equation of the tangent to the curve y = x3 – 3x2 + 2x - 1, at the point (3,5).
2. Find the equation of the normal to the curve y = 8 - 3√x at the point where x = 4.

**12G Increasing & Decreasing Functions**







1. Show that the function ;

$$f\left(x\right)=x^{3}+24x+3$$

is an increasing function.

1. Find the range of values where:

$$f\left(x\right)=x^{3}+3x^{2}-9x$$

is a decreasing function.

**12J Graphing the Gradient Function**





1. The diagram shows the curve with equation $y=f(x)$. It has an asymptote at $y=-2$, a turning point at $(-3,-8) $and it cuts the x-axis at $(-10,0)$
2. Sketch the graph of $y=f'(x)$

 

1. State the equation of the asymptote of $y=f'(x)$

**12H Second Derivatives**

1. Find $\frac{dy}{dx}$ and $\frac{d^{2}y}{dx^{2}}$ of the following:

$$y=3x^{5}+\frac{4}{x^{2}}$$

1. Find $f^{'}(x)$ and $f^{''}(x)$ of the following:

$$f\left(x\right)=3\sqrt{x}+\frac{1}{2x}$$

**12I Stationary Points**







Note on f’’(x) = 0

1. Find the coordinates of the turning point on the curve y = x4 – 32x, and state whether it is a minimum or maximum.
2. Find the stationary points on the curve: y = 2x3 – 15x2 + 24x + 6, and state whether they are minima, maxima or points of inflexion

**12K Differentiation in Context**

1. Given that the volume, $V cm^{3}$, of an expanding sphere is related to its radius, $r cm$, by the formula $V=\frac{4}{3}πr^{3}$, find the rate of change of volume with respect to radius at the instant when the radius is 5cm.
2. A large tank (shown) is to be made from 54m2 of sheet metal. It has no top.

a) Show that the Volume of the tank will be given by:

$$V=18x-\frac{2}{3}x^{3}$$

b) Find the Maximum volume of the tank