



The **topics** and **types of questions** examined in this Achievement Standard. Use this sheet to plan and organise your study so that you cover everything that is required.

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**2.3 DERIVATIVES AND INTEGRALS AS 90286**

Find and use straightforward derivatives and integrals

**2.3 1. Find the gradient at a point A**

- given a function, find the value of the gradient function at a given point.

► Find the gradient of the curve  $y = 2x^4 - x + 3$  at the point where  $x = 1$ .

**2.3 2. Find the point where the gradient has a given value A**

- given a function, find the point that has the given gradient.

► The gradient of the curve  $y = x^2 - 6x + 7$  at the point P is  $-4$ . Find the coordinates  $(x, y)$  of point P.

**2.3 3. Find the equation from the gradient function A**

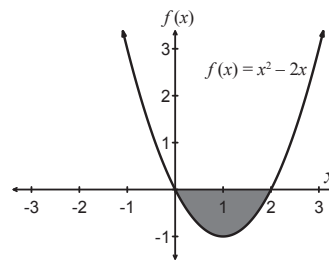
- given the gradient function and a point the curve passes through, find the equation of the curve.

► The gradient function of a curve is  $f'(x) = 8x^3 - 10x - 3$ . The curve passes through the point  $(1, -2)$ . Find the equation of the curve.

**2.3 4. Find a simple area under a graph A**

- finding the area bound by a curve and the  $x$  axis between two limits.

► The diagram shows the graph of  $f(x) = x(x - 2) = x^2 - 2x$ . Find the shaded area between  $f(x)$  and the  $x$  axis.



**2.3 5. Find the equation of a tangent to a curve M**

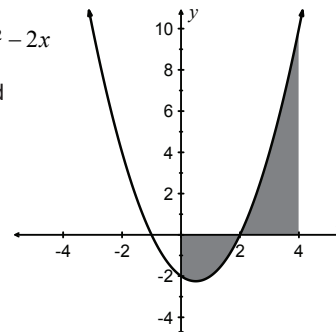
- given the equation of a curve and a point, find the equation of the tangent to the curve at the point.

► Find the equation of the tangent to the curve  $y = x^2 + x - 6$  at the point  $(1, -4)$ .

**2.3 6. Find a compound area under a graph M**

- find the area bound by a curve and the  $x$  axis where the curve cuts the  $x$  axis between the limits.

► The graph shown is  $y = x(x + 1)(x - 2) = x^3 - x^2 - 2x$ . Calculate the total shaded area.



**2.3 7. Locate turning points and determine their nature M**

- given the equation of a curve, find the coordinates of any turning points and determine their nature.

► Find the coordinates of the turning point on the curve  $y = x^2 + 4x$  and determine its nature.

**2.3 8. Kinematics M E**

- rate of change problems involving, distance, velocity and acceleration.

► The distance of a canoe from the shore is given by

$$s = 36t - 0.1t^2$$

where  $s$  is the distance in metres and  $t$  is the time in minutes since the canoe left the shore.

Calculate the maximum distance of the canoe from the shore.

**2.3 9. Rates of change M E**

- other rate of change problems

► A tank is being filled with water. The height of the water,  $h$  cm, in the tank at any time  $t$  minutes after it began filling is given by:

$$h = t^2 + 2t$$

Find the rate that the height of the water is changing at 3 minutes after the tank starts filling.

**2.3 10. Optimisation E**

- finding the maximum or minimum value of a function given some constraint.

► A  $10 \text{ cm}^3$  block of metal is to be melted and made into a cylinder that has the smallest possible surface area.

Assuming that the volume of metal does not change in the process, find the radius of the cylinder.

(For a cylinder  $V = \pi r^2 h$  and  $SA = 2\pi r^2 + 2\pi r h$ )