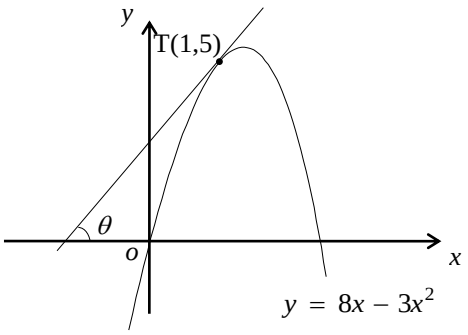
Differentiation 2

1. Differentiate $\frac{x^2 + 1}{\sqrt{x}}$, with respect to x,

2. Find $f'(x)$ when $f(x) = \frac{x^3 - 6\sqrt{x}}{x^2}$.

3. The diagram below shows the parabola with equation $y = 8x - 3x^2$ and the line which is a tangent to the curve at the point T(1,5).

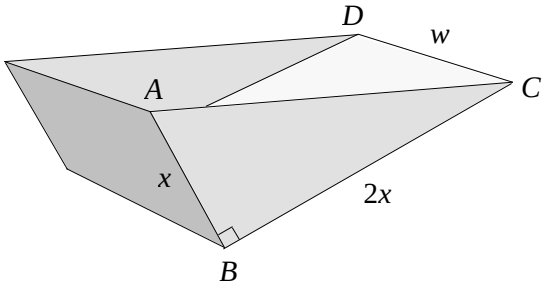


Find the size of the angle marked θ, to the nearest degree.

4. Show that the function $f(x) = 4(1-2x)^3$ is decreasing for **all** values of x, except $x = \frac{1}{2}$.

5. Show that the curves with equations $y = x^2 + 8x + 3$ and $y = 1 + 4x - x^2$ touch each other at a single point, and find the equation of the common tangent at this point.

6. Tin sheeting is bent and sealed to form a feeding trough in the shape of the prism opposite.
Angle ABC is a right-angle.
The total amount of tin plate used is $6\frac{1}{2}$ square metres.
$AB = x$, $BC = 2x$ and $CD = w$.



(a) Show that the surface area, A, in terms of x and w can be written as $A = 2x^2 + 3xw$.

(b) Hence show that $w = \frac{13}{6x} - \frac{2x}{3}$.

(c) If the volume of the trough is given as $V\ m^3$, show that $V(x) = \frac{13x}{6} - \frac{2x^3}{3}$.

(d) Hence find the values of x and w for maximum volume.
Give your answers correct to 2 decimal place.