Calculus revision 1

Due Monday 18th August

1. (a) Find the gradient of the curve given by $y = 3x^3 - x^2 + 7$ at the point $(2, 51)$

   (b) Find the x-coordinate of another point on the curve that has the same gradient as in (a).

2. Give the coordinates of the point on the curve $y = \frac{x^2}{2} + 4x$ where the gradient is equal to 30.

3. Find the equation of the tangent to the curve $y = 5x - 2x^2$ at the point where $x = 3$.

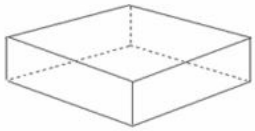
4. Find the equation of the tangent to the curve $y = \frac{2x^3}{3} - x^2 + 4x - 1$ at the point $(0, -1)$

5. For what values of x is the function $f(x) = 4x^3 + 2x^2 - 1$ decreasing?

6. The curve $f(x) = x^3 + px^2 - 5$ has a gradient of 20 at the point where $x = 2$. Find the value of p.

7. A piece of cardboard is 50cm x 30cm in size. If the corners are cut out as shown below, the cardboard can be folded into an open-topped box.

   Find the maximum volume of that box.



   Show that this is the maximum.

8. (a) A car is travelling at 20 ms^{-1} when the driver sees an obstruction ahead and slams on the brakes, decelerating at a rate of 2.5 ms^{-2}.

   How long will it take for the car to come to a complete stop?

   (b) What distance will be travelled by the car before it comes to a stop?

   (c) If the car had less effective brakes and was only able to decelerate at 1.8 ms^{-2}, what is the fastest it could speed and still be able to stop in the same distance as in (b)?