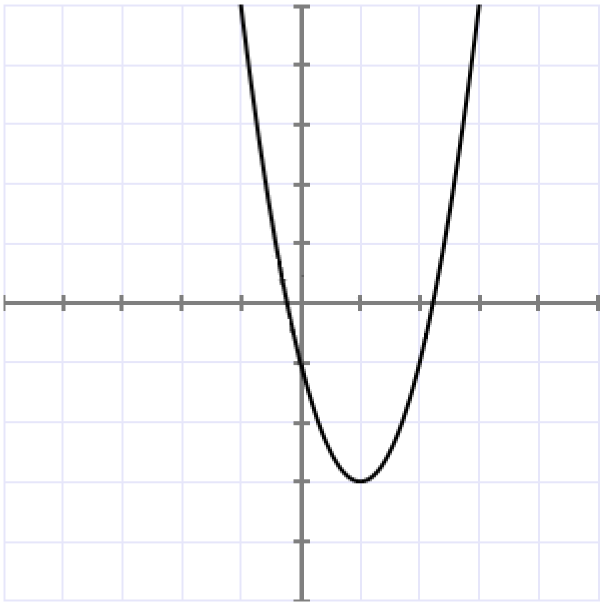
L2 Calculus Revision #3

1. For a function you know that $f'(x) = 2x^2 - 3x + 5$ and that $f(1) = 4$

   Find the equation of the function.

2. The point (**–**5, 1000) lies on the curve $y = 4x^4 - 200x - 500$.

   Find the gradient of the tangent to the curve at point .



3. Draw the gradient function for the parabola.

4. A parabola has equation $y = \frac{5x^2}{4} - 4x - 4$

   Find the value of x where the slope of the curve is 3.

5. Find the equation of the tangent to $y = 3x^3 + 4x - 6$ when $x = 2$.

6. The rate of increase of height above sea level of a plane is given by rate = $400 - 20t$ where h is height in metres and t is time in minutes

   The plane starts at 250 metres above sea level.

   When does the plane reach 2000 metres high?

Answers: L2 Calculus Revision #3

1. $f'(x) = 2x^2 - 3x + 5$ so $f(x) = \frac{2}{3}x^3 - 1.5x^2 + 5x + C$

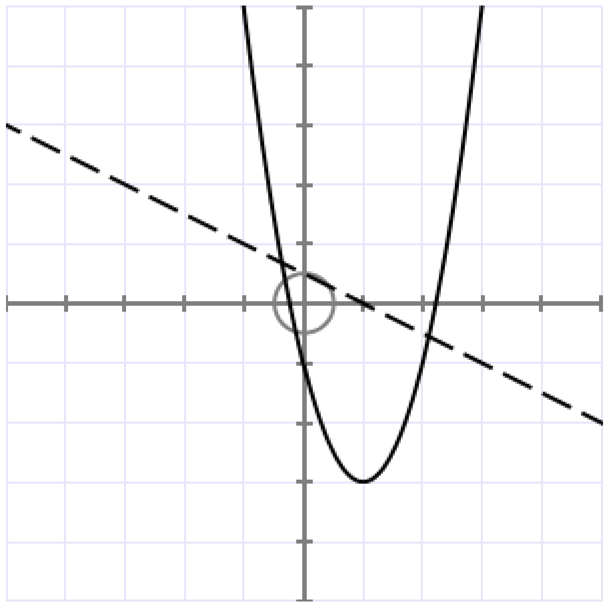
   $f(1) = 4$ so $f(1) = \frac{2}{3} \times 1^3 - 1.5 \times 1^2 + 5 \times 1 + C = 4.$ so $C = -\frac{1}{6}$

   Equation is $f(x) = \frac{2}{3}x^3 - 1\frac{1}{2}x^2 + 5x - \frac{1}{6}$

2. $y = 4x^4 - 200x - 500$ so $\frac{dy}{dx} = 16x^3 - 200$ = curve's gradient = tangent's gradient

   Gradient at $x = -5$ is $\frac{dy}{dx} = 16 \times (-5)^3 - 200 = -10$ **Gradient = –2200**

3. Any line of negative slope, with the x-intercept at the first grid line.



4 $y = \frac{5x^2}{4} - 4x - 4$ so $\frac{dy}{dx} = \frac{10x}{4} - 4$

   Point where gradient = 3 is when

   $3 = 2\frac{1}{2}x - 4$ Point at **x = 2.8**

5. $y = 3x^3 + 4x - 6$ so $\frac{dy}{dx} = 9x^2 + 4$ gradient at $x = 2$ is $9 \times 2^2 + 4 = 40$

   For $x = 2$ point is $y = 3 \times (2)^3 + 4 \times 2 - 6 = 26$ point is (2, 26)

   Use $y - y_1 = m(x - x_1)$ gives $y - 26 = 40(x - 2)$ tangent is **$y = 40x - 54$**

6. rate $= \frac{dh}{dt} = 400 - 20t$ so $h = 400t - 10t^2 + C$

   The plane starts at 250 metres high so $250 = 400 \times 0 - 10 \times 0 + C$ so $C = 250$

   To find when $h = 2000$ $2000 = 400t - 10t^2 + 250$

   Rearranging $10t^2 - 400t + 1750 = 0$ Solutions at $t = 5$ and $t = 35$

   Reaches 2000 metres after 5 minutes (and then again after 35)

Questions 5 and 6 are Merit