

4. Find the equations of all tangent lines to the curve  $y = \frac{1}{3}x^3 - x^2 + 2$  that are parallel to the line  $y = 3x - 4$ .

Parallel to  $y = 3x - 4$  means slope = 3

$$y' = x^2 - 2x = 3$$

$$x^2 - 2x - 3 = 0 \quad (x-3)(x+1) = 0$$

$$\text{so } x = -1 \text{ or } 3$$

If  $x = -1$  then  $y = \frac{1}{3}(-1)^3 - (-1)^2 + 2 = \frac{2}{3}$

$$\frac{2}{3} = 3(-1) + b \quad \text{so } b = \frac{11}{3}$$

tangent line:  $y = 3x + \frac{11}{3}$

If  $x = 3$  then  $y = \frac{1}{3}(3)^3 - (3)^2 + 2 = 2$

$$2 = 3(3) + b \quad \text{so } b = -7$$

tangent line:  $y = 3x - 7$