

Investigation Memo for Gr-12 Maths - 27 May 2017

Question 1

$$f(x+h) = \frac{3}{x+h}, \quad f(x) = \frac{3}{x}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{1}{h} \times \left(\frac{3}{x+h} - \frac{3}{x} \right)$$

$$= \lim_{h \rightarrow 0} \frac{1}{h} \times \left(\frac{3x - 3(x+h)}{x(x+h)} \right)$$

$$= \lim_{h \rightarrow 0} \frac{1}{h} \times \left(\frac{3x - 3x - 3h}{x(x+h)} \right)$$

$$= \lim_{h \rightarrow 0} \frac{-3}{x(x+h)}$$

$$= -\frac{3}{x^2}$$

$$1.2) f'(-5) = \frac{-3}{(-5)^2}$$

$$= -\frac{3}{25}$$

Question 2

$$2.1) = D_x \left[x^2 - 1 + \frac{5}{x} \right]$$
$$= 2x - \frac{5}{x^2}$$

$$2.2) 6t - 4$$

$$2.3) f(x) = (\sqrt{x} - 3)(2\sqrt{x} + 3)$$
$$= 2x - 3\sqrt{x} - 9$$
$$= 2x - 3x^{\frac{1}{2}} - 9$$
$$f'(x) = 2 - \frac{3}{2}x^{-\frac{1}{2}}$$
$$= 2 - \frac{3}{2\sqrt{x}}$$
$$= 2 - \frac{3}{2\sqrt{x}}$$

Question 3

$$g(x) = x^3 + x^2 - 8x$$

$$g'(x) = 3x^2 + 2x - 8 = -3$$

$$\therefore 3x^2 + 2x - 5 = 0$$

$$(3x + 5)(x - 1) = 0$$

$$\therefore x = -\frac{5}{3} \text{ or } x = 1$$

Tangent point of $x = -\frac{5}{3}$

$$\begin{aligned} y &= g\left(-\frac{5}{3}\right) = \left(-\frac{5}{3}\right)^3 + \left(-\frac{5}{3}\right)^2 - 8\left(-\frac{5}{3}\right) \\ &= \frac{310}{27} = 11,48 \\ &\Rightarrow \left(-\frac{5}{3}; \frac{310}{27}\right) \end{aligned}$$

Sub in $y = mx + c$

$$\frac{310}{27} = -3\left(-\frac{5}{3}\right) + c$$

$$c = \frac{175}{27} = 6,48$$

$$\therefore y = -3x + 6,48$$

Tangent point of 1

$$y = g(1) = 1 + 1 - 8(1)$$

$$= -6 \Rightarrow (1; -6)$$

Sub in $y = mx + c$

$$-6 = -3(1) + c$$

$$c = -3$$

$$\therefore y = -3x - 3$$