

Questions from Homework

$$\begin{aligned} \textcircled{1} \text{ c) } \lim_{x \rightarrow 1} \frac{(x+2)^3 - 27}{x-1} \\ \lim_{x \rightarrow 1} \frac{\overbrace{(x+2)^3}^{x^3+3x^2+6x+9} - 27}{x-1} \\ \lim_{x \rightarrow 1} (3)^3 + 3(3) + 9 = \boxed{27} \end{aligned}$$

$$\textcircled{5} \quad f(x) = 3x^3 + \frac{5}{x} - 4 \quad \text{at } x = -2$$

$$f(x) = 3x^3 + 5x^{-1} - 4$$

$$f'(x) = 6x - 5x^{-2}$$

$$f'(x) = 6x - \frac{5}{x^2}$$

$$\begin{aligned} f'(-2) &= 6(-2) - \frac{5}{(-2)^2} = -12 - \frac{5}{4} = \frac{-48}{4} - \frac{5}{4} \\ &= \boxed{\frac{-53}{4}} \end{aligned}$$

$$\begin{aligned} \textcircled{6} \text{ b) } y &= 2x^3 - 6\sqrt{x} \quad \text{at } (4, 20) \\ y &= 2x^3 - 6x^{1/2} \end{aligned}$$

$$\begin{aligned} \textcircled{1} \quad y' &= 4x - 3x^{-1/2} \\ &= 4x - \frac{3}{x^{1/2}} \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad y'(4) &= 4(4) - \frac{3}{\sqrt{4}} \\ &= 16 - \frac{3}{2} \\ &= \frac{29}{2} \quad \leftarrow \text{slope "m"} \end{aligned}$$

$$\begin{aligned} \textcircled{3} \quad y - y_1 &= m(x - x_1) \\ y - 20 &= \frac{29}{2}(x - 4) \end{aligned}$$

$$y - 20 = \frac{29x}{2} - 58$$

$$2y - 40 = 29x - 116$$

$$\boxed{0 = 29x - 2y - 76}$$

$$\textcircled{7} \text{ b) } f(x) = \sqrt[5]{x^3} = x^{3/5}$$

$$f'(x) = \frac{3}{5}x^{-2/5} = \frac{3}{5x^{2/5}} = \frac{3}{5\sqrt[5]{x^2}}$$

$$\textcircled{4} \text{ a) } f(x) = x^2 + 4x + 2 \quad f(x+h) = (x+h)^2 + 4(x+h) + 2$$

$$= x^2 + 2xh + h^2 + 4x + 4h + 2$$

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

$$= \lim_{h \rightarrow 0} \frac{\cancel{x^2} + 2xh + h^2 + \cancel{4x} + 4h + \cancel{2} - (\cancel{x^2} + \cancel{4x} + \cancel{2})}{h}$$

$$= \lim_{h \rightarrow 0} \frac{2xh + h^2 + 4h}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{h}(2x + \cancel{h} + 4)}{\cancel{h}} = \boxed{2x + 4}$$

Functions Toolkit 2

1. Solve the following $|3x-2| > 7$

$$\begin{aligned} 3x-2 &> 7 \\ 3x &> 9 \\ \boxed{x > 3} \end{aligned}$$

$$\begin{aligned} 3x-2 &< -7 \\ 3x &< -5 \\ \boxed{x < -\frac{5}{3}} \end{aligned}$$

2. Solve the following $-9 \leq |2x-5| \leq 13$

$$\begin{aligned} -9 &\leq 2x-5 \leq 13 \\ -4 &\leq 2x \leq 18 \\ \boxed{-2 \leq x \leq 9} \end{aligned}$$

$$\begin{aligned} 9 &\geq 2x-5 \geq -13 \\ 14 &\geq 2x \geq -8 \\ 7 &\geq x \geq -4 \\ \boxed{-4 \leq x \leq 7} \end{aligned}$$

3. Solve for x $1 + \sqrt{x-3} = x-2$

6. Simplify the following rational expressions.

$$\text{a) } \frac{4}{x^2 - x - 30} - \frac{2}{x^2 + 8x + 15}$$

$$\text{b) } \frac{2x}{3x+5} + \frac{x}{3x^2 - x - 10}$$

$$\text{c) } \frac{3x+6}{x^2} \times \frac{x}{x^2 + 2x}$$

$$\text{d) } \frac{\frac{2}{x} + \frac{3}{xy}}{\frac{2}{xy} + \frac{3}{y}}$$

9. Sketch the following rational function

$$\text{a) } f(x) = \frac{x^2 - 2x - 3}{x + 1}$$

