

# Math 2143 - Brief Calculus with Applications

Quiz #13 - 2008.03.26

Solutions

---

1. Compute the following limit.

$$\begin{aligned}\lim_{x \rightarrow 1} \frac{\sqrt{x^2 + x + 23} - 5}{x - 1} &= \lim_{x \rightarrow 1} \frac{\sqrt{x^2 + x + 23} - 5}{x - 1} \cdot \frac{\sqrt{x^2 + x + 23} + 5}{\sqrt{x^2 + x + 23} + 5} \\ &= \lim_{x \rightarrow 1} \frac{x^2 + x + 23 - 25}{(x - 1)(\sqrt{x^2 + x + 23} + 5)} \\ &= \lim_{x \rightarrow 1} \frac{x^2 + x - 2}{(x - 1)(\sqrt{x^2 + x + 23} + 5)} \\ &= \lim_{x \rightarrow 1} \frac{(x - 1)(x + 2)}{(x - 1)(\sqrt{x^2 + x + 23} + 5)} \\ &= \lim_{x \rightarrow 1} \frac{x + 2}{\sqrt{x^2 + x + 23} + 5} \\ &= \frac{3}{10}\end{aligned}$$

2. Compute the following derivative.

$$\frac{d}{dv} \left( v^3 \cdot \left( v - \frac{1 + 3v}{2v^2 + 1} \right) \right) = 3v^2 \cdot \left( v - \frac{1 + 3v}{2v^2 + 1} \right) + v^3 \cdot \left( 1 - \frac{(3) \cdot (2v^2 + 1) - (1 + 3v) \cdot (4v)}{(2v^2 + 1)^2} \right)$$

3. Fill in the blanks for the following statements.

a) If  $f(x)$  is increasing and concave up at  $x = a$ , then  $f'(a) > 0$  and  $f''(a) > 0$ .

b) If  $f(x)$  is decreasing and concave up at  $x = b$ , then  $f'(b) < 0$  and  $f''(b) > 0$ .

c) If  $f(x)$  has a local minimum  $x = c$ , then  $f'(c) = 0$  and  $f''(c) > 0$ .

c) If  $f(x)$  has a local maximum  $x = d$ , then  $f'(d) = 0$  and  $f''(d) < 0$ .