

WRITE YOUR NAME:

MAC 2311 Homework 1

Due in class, Monday August 28th

You can use more paper if necessary, but please STAPLE

Question 1. If  $f(x) = x^2$ , find and simplify each of the following.

- $f(7)$
- $f(-7)$
- $f(7.02)$
- $f(7+h)$
- $f(7)+h$

$$f(7) = 7^2 = 49$$

$$f(-7) = (-7)^2 = 49$$

$$f(7.02) = (7.02)^2 = 49.2804$$

$$\begin{array}{r} 702 \\ -702 \\ \hline 1404 \\ 4914 \\ \hline 492804 \end{array}$$

$$\begin{aligned} f(7+h) &= (7+h)^2 = (7+h)(7+h) \\ &= 7 \cdot 7 + 7 \cdot h + h \cdot 7 + h \cdot h \\ &= 7^2 + 2 \cdot 7 \cdot h + h^2 \\ &= 49 + 14h + h^2 \end{aligned}$$

$$f(7)+h = 7^2 + h = 49 + h$$

$$\begin{aligned} \text{BTW Note } (7.02)^2 &= (7+0.02)^2 = 7^2 + 2 \cdot 7 \cdot 0.02 + 0.02^2 \\ &= 49 + 14 \cdot 0.02 + 0.0004 \\ &= 49 + 0.28 + 0.0004 \\ &= 49.2804 \end{aligned}$$

Question 2. Expand and simplify each of the following.

- $(a-b)(a+b)$
- $(\sqrt{x+h}-\sqrt{x})(\sqrt{x+h}+\sqrt{x})$

$$(a-b)(a+b) = a^2 - b^2$$

$$\begin{aligned} \text{[The reason: } (a-b)(a+b) &= (a+(-b))(a+b) \\ &= a \cdot a + a \cdot b + (-b) \cdot a + (-b) \cdot b \\ &= a^2 + ab - ab - b^2 \\ &= a^2 - b^2 \end{aligned}$$

Of course, to save time, you just remember  $(a-b)(a+b) = a^2 - b^2$  ]

$$(\sqrt{x+h} - \sqrt{x})(\sqrt{x+h} + \sqrt{x})$$

$$= (\sqrt{x+h})^2 - (\sqrt{x})^2$$

$$= x+h - x = h$$

Question 3. Evaluate the limit. (Hint: Do some algebra.)

$$\lim_{x \rightarrow 0} \frac{\sqrt{x+1} - 1}{x}$$

$$\lim_{x \rightarrow 0} \frac{\sqrt{x+1} - 1}{x} \cdot \frac{\sqrt{x+1} + 1}{\sqrt{x+1} + 1}$$

$$= \lim_{x \rightarrow 0} \frac{(\sqrt{x+1})^2 - 1^2}{x(\sqrt{x+1} + 1)}$$

$$= \lim_{x \rightarrow 0} \frac{x+1 - 1}{x(\sqrt{x+1} + 1)}$$

$$= \lim_{x \rightarrow 0} \frac{x}{x(\sqrt{x+1} + 1)}$$

$$= \lim_{x \rightarrow 0} \frac{1}{\sqrt{x+1} + 1} = \frac{1}{\sqrt{0+1} + 1}$$

$$= \frac{1}{\sqrt{1+1}} = \frac{1}{1+1} = \frac{1}{2}$$