

MTH 261 Homework #1 Key

(✓)

1. a. see attached graph

b.  $(-\infty, \infty)$

c.  $(-\infty, 4)$

d.  $g(-2) = 2$

e.  $g(0) = 1$

f.  $g(-5) = 1$

g.  $\lim_{x \rightarrow 0} g(x) = 1$

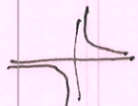
h.  $\lim_{x \rightarrow -2^+} g(x) = 2$

i.  $\lim_{x \rightarrow -2^-} g(x) = 4$

j.  $\lim_{x \rightarrow -2} g(x) = \text{DNE}$

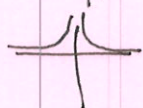
k. it is not at  $x = -2$  since  $\lim$  does not exist

2.  $\lim_{x \rightarrow 0} \frac{1}{x} = \text{DNE}$



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

$\lim_{x \rightarrow 0} \frac{1}{x^2} = \infty$



$\lim_{x \rightarrow 0^+} \frac{1}{x^2} = \lim_{x \rightarrow 0^-} \frac{1}{x^2} = \infty$

3.  $\lim_{x \rightarrow 2} \frac{x^3 - 8}{2 - x} = -12$

4. see table

5. see attached graphs

6. a.  $\frac{(x+h)^2 - (x+h) - (x^2 - x)}{h} = \frac{x^2 + 2xh + h^2 - x - h - x^2 + x}{h} = \frac{h(2x + h - 1)}{h} = 2x + h - 1$

b.  $\frac{(x+h)^3 - x^3}{h} = \frac{x^3 + 3x^2h + 3xh^2 + h^3 - x^3}{h} = \frac{h(3x^2 + 3xh + h^2)}{h} = 3x^2 + 3xh + h^2$

c.  $\frac{\frac{1}{\sqrt{x+h}} - \frac{1}{\sqrt{x}}}{h} = \frac{\frac{\sqrt{x} - \sqrt{x+h}}{h\sqrt{x}\sqrt{x+h}} \cdot \frac{\sqrt{x} + \sqrt{x+h}}{\sqrt{x} + \sqrt{x+h}}}{\frac{\sqrt{x} + \sqrt{x+h}}{\sqrt{x} + \sqrt{x+h}}} = \frac{x - x - h}{h\sqrt{x}\sqrt{x+h}(\sqrt{x} + \sqrt{x+h})} = \frac{-h}{h\sqrt{x}\sqrt{x+h}(\sqrt{x} + \sqrt{x+h})} = \frac{-1}{\sqrt{x}\sqrt{x+h}(\sqrt{x} + \sqrt{x+h})}$

d.  $\frac{\frac{1}{x+h+9} - \frac{1}{x+9}}{h} = \frac{\frac{x+9 - x-h-9}{h(x+h+9)(x+9)}}{\frac{x+9 - x-h-9}{h(x+h+9)(x+9)}} = \frac{-h}{h(x+h+9)(x+9)} = \frac{-1}{(x+h+9)(x+9)}$

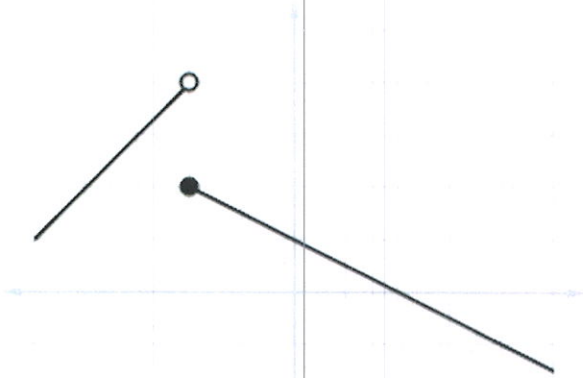
7. a.  $\lim_{h \rightarrow 0} \frac{-2(x+h)^2 - (-2x^2)}{h} = \frac{-2x^2 - 4xh - 2h^2 + 2x^2}{h} = \frac{h(-4x - 2h)}{h} = -4x$

b.  $f'(1) = -4(1) = -4$

c.  $f(1) = -2(1)^2 = -2$  (1, -2)

tangent line

$y + 2 = -4(x - 1) \Rightarrow y + 2 = -4x + 4 \Rightarrow y = -4x + 2$



1	1.9	1.99	1.999	1.9999	2.0001	2.001	2.01	2.1	3
-7	-11.41	-11.9401	-11.994	-11.9994	-12.0006	-12.006	-12.0601	-12.61	-19

x	R(x)	rate of change
40,000	165.463	
40,001	165.464	0.001034
41,000	166.4876	0.001025
50,000	174.9558	0.000949
60,000	183.1149	0.000883

