HMWK 2 KEY Calc 1

Section 2.1

5) If a ball is thrown into the air with a velocity of 40 ft/s, its height in feet t seconds later is given by $y = 40t - 16t^2$.

a) Find the average velocity for the time period beginning when $t = 2$ and lasting

$y(2) = 40(2) - 16(2)^2 = 80 - 64 = 16$

$(2, 16)$

1) 0.5 seconds $\Rightarrow t = 2.5$

$y(2.5) = 40(2.5) - 16(2.5)^2 = 100 - 100 = 0$

$\Rightarrow (2.5, 0)$

$m = \dfrac{16 - 0}{2 - 2.5} = \dfrac{16}{0.5} = \boxed{-32 \text{ ft/s}}$

2) 0.1 seconds

$y(2.1) = 40(2.1) - 16(2.1)^2 = \frac{336}{25}$ 13.44

$\Rightarrow (2.1, \frac{336}{25})$

$m = \dfrac{16 - \frac{336}{25}}{2 - 2.1} = -\dfrac{128}{5} = \boxed{-25.6 \text{ ft/s}}$

3) 0.05 seconds $\Rightarrow t = 2.05$

$y(2.05) = 40(2.05) - 16(2.05)^2 = \frac{369}{25}$

$\Rightarrow (2.05, \frac{369}{25})$ 14.76

$m = \dfrac{16 - \frac{369}{25}}{2 - 2.05} = \boxed{-24.8 \text{ ft/s}}$

4) 0.01 seconds $\Rightarrow t = 2.01$

$y(2.01) = 40(2.01) - 16(2.01)^2 = \frac{9849}{625}$

$\Rightarrow (2.01, \frac{9849}{625})$ 15.7584

$m = \dfrac{16 - \frac{9849}{625}}{2 - 2.01} = \boxed{-24.16 \text{ ft/s}}$

b) Estimate the instantaneous velocity at $t = 2$

t	2.5	2.1	2.05	2.01
avg vel	-32	-25.6	-24.8	-24.16

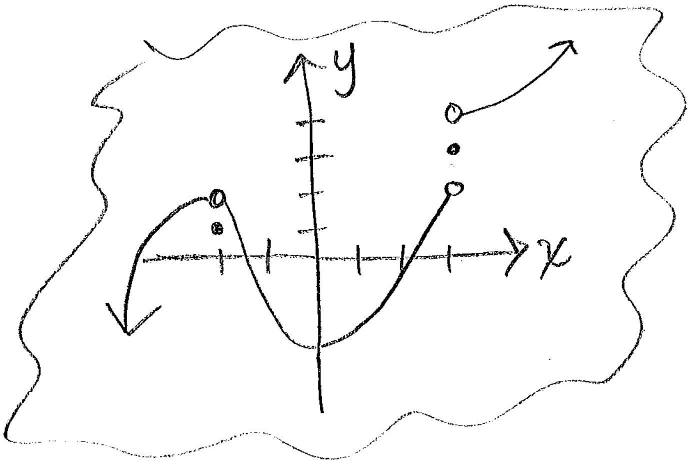
Instantaneous velocity $\approx \boxed{-24 \text{ ft/s}}$

Section 2.2

(17) Sketch the graph of a function that satisfies

$$\lim_{x\to 3^+} f(x)=4, \quad \lim_{x\to 3^-} f(x)=2, \quad \lim_{x\to -2} f(x)=2,$$

$$f(3)=3, \text{ and } f(-2)=1$$



(34) Determine the infinite limit. $\lim_{x\to 3^-} \frac{\sqrt{x}}{(x-3)^5}$

Solution: Note that $\sqrt{x} \geq 0$ over its domain $[0,\infty)$.

For x close but less than 3, $x-3$ is a negative number w/ small magnitude. Thus $(x-3)^5$ is also a negative number w/ small magnitude.

Therefore, $\lim_{x\to 3^-} \frac{\sqrt{x}}{(x-3)^5} = -\infty$

Section 2.3

(2) For the graphs presented in the textbook,

a) $\lim_{x\to 2} [f(x)+g(x)] = \lim_{x\to 2} f(x) + \lim_{x\to 2} g(x) = -1+2 = \boxed{1}$

b) $\lim_{x\to 0} [f(x)-g(x)]$ $\boxed{\text{DNE}}$ since $\lim_{x\to 0} g(x)$ DNE

c) $\lim_{x\to -1} [f(x)g(x)] = \left[\lim_{x\to -1} f(x)\right]\left[\lim_{x\to -1} g(x)\right] = (1)(2) = \boxed{2}$

d) $\lim_{x\to 3} \frac{3f(x)}{g(x)}$ $\boxed{\text{DNE}}$ since $\lim_{x\to 3} g(x) = 0$

e) $\lim_{x\to 2} [x^2 f(x)] = (\lim_{x\to 2} x^2)(\lim_{x\to 2} f(x)) = (4)(-1) = \boxed{-4}$

f) $f(-1) + \lim_{x\to -1} g(x) = 3 + 2 = \boxed{5}$

Evaluate the limits using the appropriate limit laws.

(4) $$\lim_{x\to -1}(x^4-3x)(x^2+5x+3) = \left[\lim_{x\to -1}(x^4-3x)\right]\left[\lim_{x\to -1}(x^2+5x+3)\right]$$

$$= \left[(-1)^4-3(-1)\right]\left[(-1)^2+5(-1)+3\right]$$

$$= (1+3)(1-5+3) = 4\cdot(-1) = \boxed{-4}$$

(8) $$\lim_{t\to 2}\left(\frac{t^2-2}{t^3-3t+5}\right)^2 = \left(\lim_{t\to 2}\frac{t^2-2}{t^3-3t+5}\right)^2$$

$$= \left(\frac{\lim_{t\to 2}(t^2-2)}{\lim_{t\to 2}(t^3-3t+5)}\right)^2$$ since $\lim_{t\to 2}(t^3-3t+5)\neq 0$

$$= \left(\frac{2}{7}\right)^2 = \boxed{\frac{4}{49}}$$