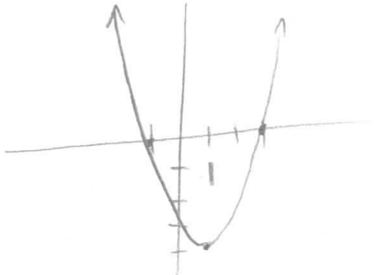
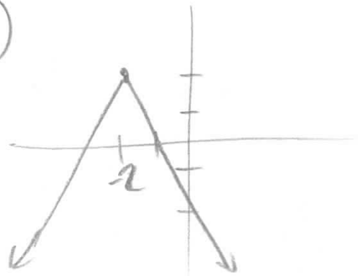
5.1 July 21

(1)



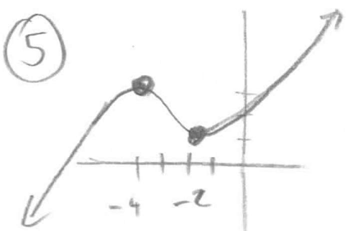
increasing $(1, \infty)$
decreasing $(-\infty, 1)$

(3)



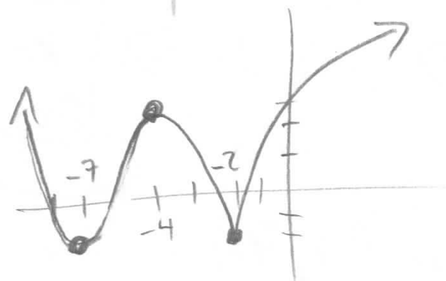
increasing $(-\infty, -2)$
decreasing $(-2, \infty)$

(5)



increasing $(-\infty, -4) \cup (-2, \infty)$
decreasing $(-4, -2)$

(7)

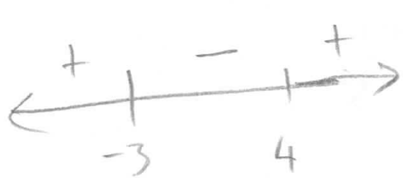


increasing $(-7, -4) \cup (-2, \infty)$
decreasing $(-\infty, -7) \cup (-4, -2)$

(15) $f(x) = \frac{2}{3}x^3 - x^2 - 24x - 4$, $f'(x) = 2x^2 - 2x - 24$

$f'(x) = 0 = 2(x^2 - x - 12) = 2(x-4)(x+3) \Rightarrow$ $\boxed{x = 4, -3 \text{ crit. numbers}}$

f'



f increasing on $(-\infty, -3) \cup (4, \infty)$

f decreasing on $(-3, 4)$

(19) $f(x) = x^4 + 4x^3 + 4x^2 + 1$, $f'(x) = 4x^3 + 12x^2 + 8x$

$f'(x) = 0 = 4x(x^2+3x+2) = 4x(x+2)(x+1) \Rightarrow$ $\boxed{x = 0, -1, -2 \text{ crit. numbers}}$

f': $-$ | $+$ | $-$ | $+$ at -2, -1, 0

f increasing on $(-2,-1) \cup (0,\infty)$

f decreasing on $(-\infty,-2) \cup (-1,0)$

(29) $y = x - 4\ln(3x-9)$ has domain $(3,\infty)$

$y' = 1 - 4 \cdot \frac{3}{3x-9} = 1 - \frac{4}{x-3}$ (undefined at $x=3$ which is not in domain of y)

$y' = 0 = 1 - \frac{4}{x-3} \Rightarrow \frac{4}{x-3} = 1 \Rightarrow x-3=4 \Rightarrow$ $\boxed{x = 7 \text{ crit. number}}$

y': undef | $+$ | $-$ at 3, 7

y increasing on $(3,7)$

y decreasing on $(7,\infty)$

(31) $f(x) = xe^{-3x}$, $f'(x) = x(-3e^{-3x}) + e^{-3x} = e^{-3x}(1-3x)$

$f'(x) = 0 = e^{-3x}(1-3x) \Rightarrow$ $\boxed{x = \frac{1}{3} \text{ crit. number}}$

f': $+$ | $-$ at $1/3$

f increasing on $(-\infty, \frac{1}{3})$

f decreasing on $(1/3, \infty)$

(47) $C(x) = .32x^2 - .00004x^3$

$R(x) = .848x^2 - 0.0002x^3$ $\quad \underline{0 \le x \le 3300}$ domain

$P(x) = R(x) - C(x) = .528x^2 - .00016x^3$

$P'(x) = 1.056x - .00048x^2 = x(1.056 - .00048x)$

$P'(x) = 0 = x(1.056 - .00048x) \Rightarrow x = 0, 2200$

P': undef | 0 | + | 2200 | − | 3300 | undef

P increasing on $(0, 2200)$

(52) $P(t) = \dfrac{10\ln(.19t+1)}{.19t+1}$ domain $[0, \infty)$

$$P'(t) = 10\left(\frac{\cancel{(.19t+1)}\frac{.19}{\cancel{.19t+1}} - \ln(.19t+1)(.19)}{(.19t+1)^2}\right)$$

$$= \frac{1.9(1 - \ln(.19t+1))}{(.19t+1)^2}$$

P' is defined on $[0, \infty)$, $P'(t) = 0 \Rightarrow 1 - \ln(.19t+1) = 0$

$\Rightarrow 1 = \ln(.19t+1) \Rightarrow e = .19t+1 \Rightarrow$ $t = \dfrac{e-1}{.19} \approx 9.04$ crit. number

P': undef | 0 | + | 9.04 | −

P is increasing on $(0, 9.04)$

P is decreasing on $(9.04, \infty)$

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$$F(t) = -10.28 + 175.9\, t\, e^{-t/1.3}$$

domain $(0, \infty)$

$$F'(t) = 175.9\left(t\left(\frac{-1}{1.3} e^{-t/1.3}\right) + e^{-t/1.3}\right)$$

$$= 175.9\, e^{-t/1.3}\left(1 - \frac{t}{1.3}\right)$$

$F'(t) = 0 \Rightarrow \boxed{t = 1.3 \text{ crit. number}}$

F increasing on $(0, 1.3)$

F decreasing on $(1.3, \infty)$

F': undef | 0 | $+$ | 1.3 | $-$

- Metabolism increases for 1.3 hrs, then decreases.