MATH 130 - EXAM 1 - FALL 2014 - Boyle - Solutions

① (a) $(-\infty, 5)$

(b) -4

(c) $\ln x + \ln(3x) = -1 \rightarrow \ln(3x^2) = -1$

[redacted]

$$3x^2 = e^{-1} = \frac{1}{e}$$

$$x^2 = \frac{1}{3e}$$

$$x = \sqrt{1/3e}$$

or $\boxed{x = \frac{1}{\sqrt{3e}}}$

2 (a) $16^{2x+1} = 64^{x-2}$

$$(2^4)^{2x+1} = (2^6)^{x-2}$$

$$2^{8x+4} = 2^{6x-12}$$

$$8x+4 = 6x-12$$

$$2x = -16$$

$$\boxed{x = -8}$$

(b) population $y = (1.06)^t y_0$ (t in years)

$$= y_0 e^{(\ln(1.06))t}$$

doubling time is sdn. t to $2 = e^{(\ln 1.06)t}$

" " $= \boxed{\frac{\ln 2}{\ln 1.06} \text{ years}}$

3(a) $1/\sqrt{2}$

(b) $\pi/4$ and $5\pi/4$

(c) amplitude $= \frac{1}{2}$ period $= 1/3$

4(a) 1

(b) $\lim_{x \to -2} \frac{x^2-x-6}{x+2} = \lim_{x \to -2} \frac{\cancel{(x+2)}(x-3)}{\cancel{(x+2)}} = \boxed{-5}$

(c) $\boxed{E}$ (Note, $e^{-a(s-h)/E} = e^{-s(a/E)} \underbrace{e^{ah/E}}_{\text{positive number}}$, and $\lim_{s \to \infty} e^{-s(a/E)} = 0$.)

5 (a) DNE (the onesided limits, 1 and -1, are different)

(b) 0

(c) $\lim\limits_{x\to-\infty} \dfrac{3x^3+10x^2-1}{4x^2+5x+2} = \lim\limits_{x\to-\infty} \dfrac{3x^3}{4x^2} = \lim\limits_{x\to-\infty} \dfrac{3x}{4} = \boxed{-\infty}$

6 (a) $\dfrac{s(2)-s(0)}{2-0} = \dfrac{(5(2)^2+3(2)+2)-(0)}{2} = \dfrac{28}{2}$

$\boxed{14 \text{ ft/sec}}$

(b) $s'(t) = 10t+3 \qquad s'(2) = \boxed{23 \text{ ft/sec}}$

7 (a) $y = \dfrac{6}{\sqrt{x}} = 6x^{-1/2}$

$y' = 6\left(\frac{-1}{2}\right)x^{-1/2-1} =$ [redacted] $= -3x^{-3/2} = -3\left(\dfrac{1}{\sqrt{x}}\right)^3$

At $x=4$, this is [redacted] $-3\left(\dfrac{1}{2}\right)^3 = \boxed{\dfrac{-3}{8}}$

(b) $y = x^3 + \frac{1}{x} + 1 = x^3 + x^{-1} + 1$

$y' = 3x^2 - x^{-2} = 3x^2 - \dfrac{1}{x^2}$

when $x = 1$, $y' = 3-1 = 2$

Eqn for tangent line at (1,3): $\boxed{y = 3 + 2(x-1)}$

or $\boxed{y = 2x+1}$

8. area $A = \pi r^2$

$A'(r) = 2\pi r$

~~At — A(2~~) Change in area $= A(1.8) - A(2)$

$\approx A'(2)(1.8-2)$

$= 4\pi(-.2) = \boxed{-(.8)\pi \text{ mm}^2}$