① $b(t) = b_0 e^{rt}$

$b(1) = 6 = b_0 e^{r}$

$b(2) = 7 = b_0 e^{r \cdot 2} = b_0 (e^{r})^2$

$e^{r} = \frac{6}{b_0}$ $7 = b_0 \left(\frac{6}{b_0}\right)^2$

$7 = \frac{6^2}{b_0}$, $b_0 = \frac{6^2}{7}$

≈ 5.143

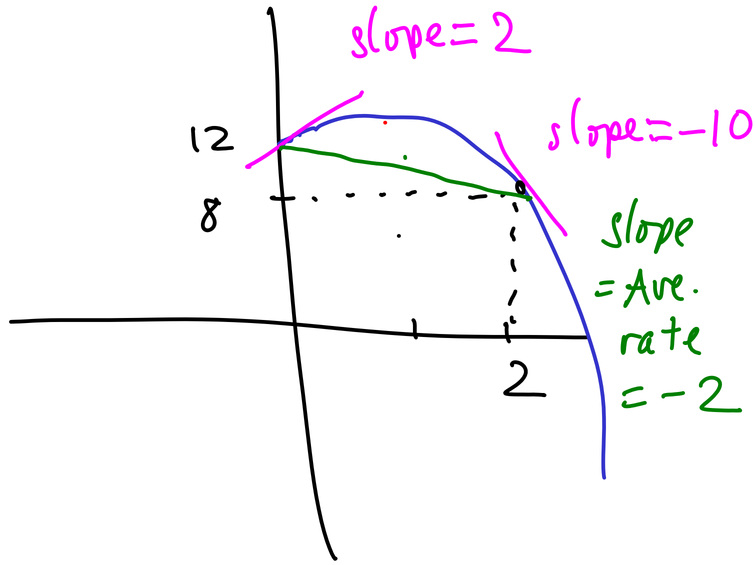
$6 = \frac{6^2}{7} e^{r}$ $e^{r} = \frac{7}{6}$ $r = \ln\left(\frac{7}{6}\right)$

≈ 0.15415

$b(t) = 5.143\, e^{0.15415 \cdot t}$

$b(3) = 5.143\, e^{0.15415 \cdot 3} \approx \boxed{8.2 \text{ mil}}$

② $s(t) = 12 + 2t - t^3$



a) $s(0) = 12$

$s(2) = 8$

$$s'(t) = \lim_{h \to 0} \frac{s(t+h) - s(t)}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{12} + 2(t+h) - (t+h)^3 - (\cancel{12} + 2t - t^3)}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{2t} + 2\cancel{h} - \cancel{t^3} - 3t^2\cancel{h} - 3th^{\cancel{2}} - h^{\cancel{3}\,2} - \cancel{2t} + \cancel{t^3}}{\cancel{h}}$$

$$= \lim_{h \to 0} (2 - 3t^2 - 3th - h^2) = \boxed{2 - 3t^2}$$

b) $s'(0) = 2$, $s'(2) = -10$

c) Ave. rate: $\dfrac{\Delta s}{\Delta t} = \dfrac{8-12}{2-0} = \boxed{-2}$

③ $f(x) = 20 - 2x^2$

$$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h} = \lim_{h\to 0}\frac{\cancel{20} - 2(x+h)^2 - (\cancel{20} - 2x^2)}{h}$$

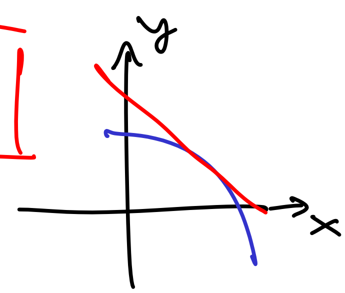
$$= \lim_{h\to 0} \frac{\cancel{-2x^2} - 4x\cancel{h} - 2h^{\cancel{2}} + \cancel{2x^2}}{\cancel{h}}$$

$$= \lim_{h\to 0}(-4x-2h) = \boxed{-4x}$$

$$y(x+h) = y(x) + y'(x)h \cancel{+\varepsilon}$$

$$y(\underbrace{2+h}_{x}) = y(2) + y'(2)h = 12 - 8\cdot h$$

$$y = 12 - 8(x-2) = \boxed{28 - 8x}$$



④ a) $\lim_{n\to\infty} \frac{n}{5n+1} = \lim_{n\to\infty} \frac{1}{5+\frac{1}{n}}$

$= \frac{1}{5 + \lim_{n\to\infty} \frac{1}{n}} = \frac{1}{5+0} = \frac{1}{5}$

b) $\lim_{x\to 1} \frac{1-x}{1-x^2} = \lim_{x\to 1} \frac{\cancel{1-x}}{\cancel{(1-x)}(1+x)}$

$= \lim_{x\to 1} \frac{1}{1+x} = \frac{1}{2}$

c) $\lim_{x\to 0} x^2 \sin\left(\frac{1}{x}\right) = 0$

Sandwich: $-1 \le \sin\left(\frac{1}{x}\right) \le 1$

$-x^2 \le x^2 \sin\left(\frac{1}{x}\right) \le x^2$

0

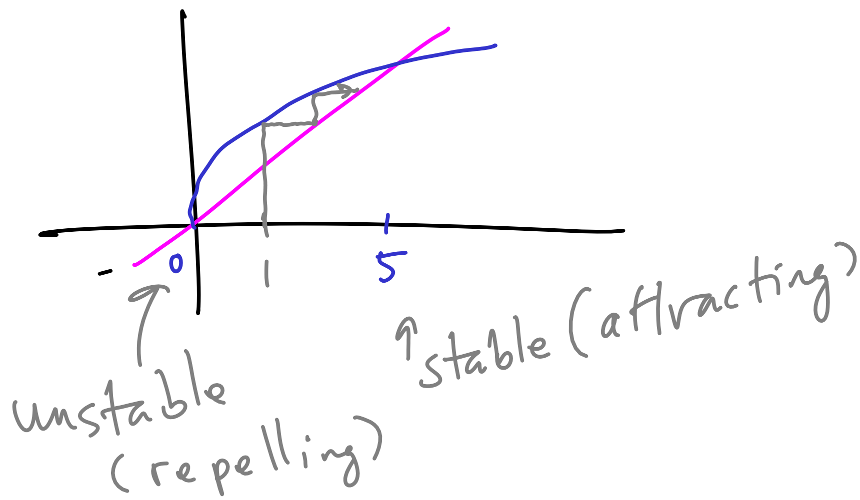
d) $\lim_{x\to 0} \frac{x}{\sin(3x)} =$

$= \lim_{x\to 0} \frac{3x}{\sin(3x)} \cdot \frac{1}{3} = 1 \cdot \frac{1}{3} = \frac{1}{3}$

(5) $x_{t+1} = \sqrt{5 x_t}$

Fixed pts: $x = \sqrt{5}\sqrt{x}$

$x = 0$ or $\sqrt{x} = \sqrt{5}$, $x = 5$



If $x_0 = 0$, $x_n = 0$ for all n

If $x_0 = 1$, $x_n \to 5$ as $n \to \infty$