

2.1

3.  $y = \frac{x-1}{x-2}$  at (3,2) we need  $f'(3)$

$$f' = \lim_{h \rightarrow 0} \frac{\frac{x+h-1}{x+h-2} - \frac{x-1}{x-2}}{h}$$

$$\begin{aligned} f'(3) &= \lim_{h \rightarrow 0} \frac{\frac{h+2}{h+1} - 2}{h} = \lim_{h \rightarrow 0} \frac{h+2-2(h+1)}{h} \\ &= \lim_{h \rightarrow 0} \frac{-h}{h} = \textcircled{-1} \end{aligned}$$

$$\boxed{y-2 = -1(x-3)}$$

8a  $y = \frac{1}{\sqrt{x}}$

$$f'(x) = \lim_{h \rightarrow 0} \frac{\frac{1}{\sqrt{x+h}} - \frac{1}{\sqrt{x}}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\sqrt{x} - \sqrt{x+h}}{h\sqrt{x}\sqrt{x+h}}$$

$$= \lim_{h \rightarrow 0} \frac{x - (x+h)}{h\sqrt{x}\sqrt{x+h}(\sqrt{x} + \sqrt{x+h})}$$

$$= \lim_{h \rightarrow 0} \frac{-h}{h}$$

$$= \frac{-1}{\sqrt{x}\sqrt{x}(\sqrt{x} + \sqrt{x})} = \frac{-1}{2x\sqrt{x}}$$

Slope at  $x=a$  is  $\frac{-1}{2a\sqrt{a}}$

8b at  $(1,1)$  slope is  $-\frac{1}{2}$   $y-1 = -\frac{1}{2}(x-1)$

at  $(4, \frac{1}{2})$  slope is  $\frac{-1}{2 \cdot 4 \cdot 2} = -\frac{1}{16}$

$$y - \frac{1}{2} = -\frac{1}{16}(x-4)$$

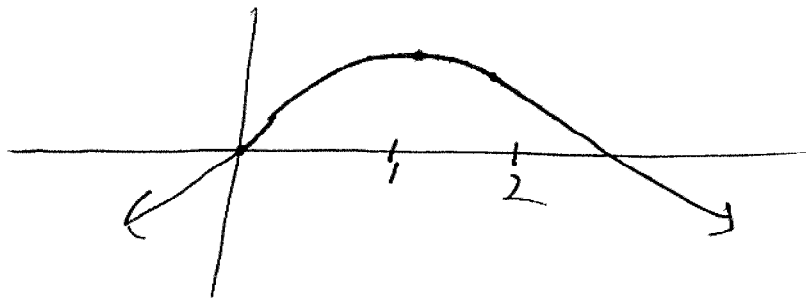
10. a. A runs at constant speed

B starts slower and accelerates

b.  $\approx t = 8.5$

c.  $\approx t = 8.5$

17.



25.  $f(t) = \frac{2t+1}{t+3}$

$$f'(t) = \lim_{h \rightarrow 0} \frac{\frac{2(t+h)+1}{t+h+3} - \frac{2t+1}{t+3}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{(t+3)(2t+2h+1) - (2t+1)(t+h+3)}{h(t+3)(t+h+3)}$$

$$= \lim_{h \rightarrow 0} \frac{2t^2 + 2th + t^2 + (t+h)^2 + 3 - 2t^2 - 2th - t^2 - t - h - 3}{h(t+3)(t+h+3)}$$

$$= \lim_{h \rightarrow 0} \frac{5h}{h(t+3)(t+h+3)} = \frac{5}{(t+3)^2}$$

27.

$$f(x) = \frac{1}{\sqrt{x+2}} \quad f'(x) = \lim_{h \rightarrow 0} \frac{\frac{1}{\sqrt{x+h+2}} - \frac{1}{\sqrt{x+2}}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\sqrt{x+2} - \sqrt{x+h+2}}{h(\sqrt{x+h+2})(\sqrt{x+2})}$$

$$= \lim_{h \rightarrow 0} \frac{x+2 - (x+h+2)}{h(\sqrt{x+h+2})(\sqrt{x+2})(\sqrt{x+2} + \sqrt{x+h+2})}$$

$$= \lim_{h \rightarrow 0} \frac{-1}{\sqrt{x+h+2} \sqrt{x+2} (\sqrt{x+2} + \sqrt{x+h+2})}$$

$$= \frac{-1}{2(x+2)\sqrt{x+2}}$$

29.  $f(x) = x^{10}$   $a = 1$

30.  $f(x) = \sqrt[4]{x}$   $a = 16$

45. a. rate of change of oxygen solubility with respect to water temp

$$\text{mg/L/}^\circ\text{C}$$

b.  $S'(16) \approx -1/4$

as  $T$  hits  $16^\circ$  the ~~rate~~ oxygen solubility is decreasing about  $-0.25 \text{ mg/L/}^\circ\text{C}$

46. a.  $S'(1)$  is rate of change of swimming speed with respect to time.

units are  $\text{cm/s/}^\circ\text{C}$

b.  $S'(15) \approx +1$

$S'(25) \approx -2$