Section 3.1: 1, 3, 5, 10-16 all, 21, 23, 29, 33

1. $f(x) = \frac{1}{x}$, $a = 2$

$$f'(2) = \lim_{h\to 0} \frac{f(2+h)-f(2)}{h} = \lim_{h\to 0} \frac{\frac{1\cdot 2}{(2+h)2} - \frac{1(2+h)}{2(2+h)}}{h} = \lim_{h\to 0} \frac{\frac{2-2-h}{4+2h}}{h}$$

$$\lim_{h\to 0} \frac{-h}{4+2h}\cdot\frac{1}{h} = \lim_{h\to 0} \frac{-1}{4+2h} = \frac{-1}{4+0} = \boxed{\frac{-1}{4}}$$

3. $f(x) = 3-x^2$, $a = -1$

$$f'(-1) = \lim_{h\to 0} \frac{f(-1+h)-f(-1)}{h} = \lim_{h\to 0} \frac{3-(-1+h)^2-3+(-1)^2}{h} = \lim_{h\to 0} \frac{1+2h-h^2+1}{h}$$

$$\lim_{h\to 0} 2-h = 2-0 = \boxed{2}$$

5. $f(x) = \frac{1}{x}$, $a = 2$

$$f'(2) = \lim_{x\to 2} \frac{f(x)-f(2)}{x-2} = \lim_{x\to 2} \frac{\frac{1\cdot 2}{x\cdot 2} - \frac{1\cdot x}{2\cdot x}}{x-2} = \lim_{x\to 2} \frac{\frac{2-x}{2x}}{x-2} = \lim_{x\to 2} \frac{\frac{-(x-2)}{2x}}{x-2}$$

$$\lim_{x\to 2} \frac{-(x-2)}{2x}\cdot\frac{1}{x-2} = \lim_{x\to 2} \frac{-1}{2x} = \frac{-1}{2\cdot 2} = \boxed{\frac{-1}{4}}$$

10. $y = 7x$

$$\frac{dy}{dx} = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h} = \lim_{h\to 0} \frac{7(x+h)-7x}{h} = \lim_{h\to 0} \frac{7x+7h-7x}{h} = \boxed{7}$$

11. $y = x^2$

$$\frac{dy}{dx} = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h} = \lim_{h\to 0} \frac{(x+h)^2-x^2}{h} = \lim_{h\to 0} \frac{x^2+2xh+h^2-x^2}{h}$$

$$\lim_{h\to 0} 2x+h = 2x+0 = \boxed{2x}$$

12. $f(x) = 3x^2$

$$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h} = \lim_{h\to 0} \frac{3(x+h)^2-3x^2}{h} = \lim_{h\to 0} \frac{3x^2+6xh+3h^2-3x^2}{h}$$

$$\lim_{h\to 0} 6x+3h = 6x+0 = \boxed{6x}$$

13. B

14. A

15. D

16. C

21. a) Steepest positive slope around end of March / beginning of April

slope $\approx \frac{9\text{ hr}}{60\text{ days}} = \frac{3}{20}$ hr/day = 9 min/day

b) Horizontal slope $\approx$ July 1, January 1

c) Positive slope: Janvary 1 – June 30
Negative slope: July 1 – December 31

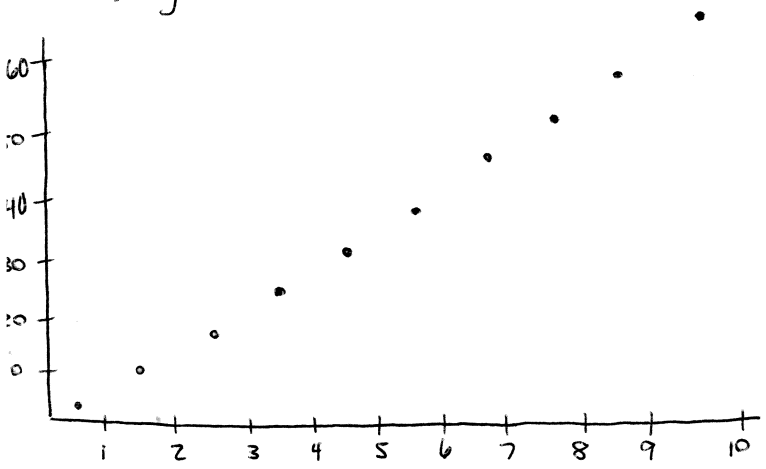
23. a) 0

b) 1700, 1300

29. a) $\frac{\text{distance}}{\text{time}}$ = velocity

b) Feet per second

c) $y = 6.653x$



Midpoint	Velocity ($\Delta y/\Delta x$)
0.5	3.3
1.5	10
2.5	16.6
3.5	23.3
4.5	30
5.5	36.6
6.5	43.2
7.5	49.9
8.5	56.6
9.5	63.2

$m = \frac{\Delta y}{\Delta x} = \frac{63.2}{9.5} \approx 6.653$

33. $y = \sin x$

$y' = \cos x$

When the slope of sinx is positive, cosx has a positive y value.
When the slope of sinx is negative, cosx has a negative y value.