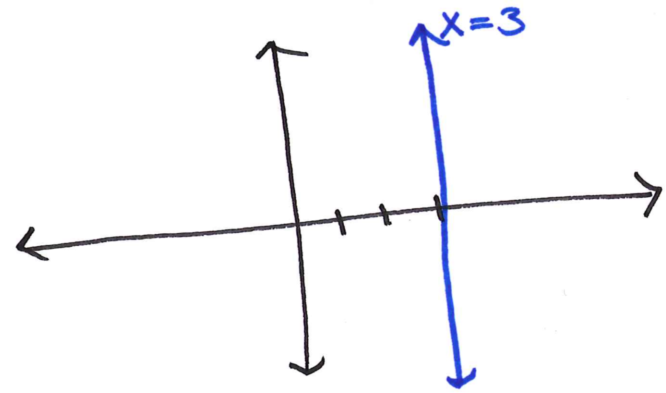
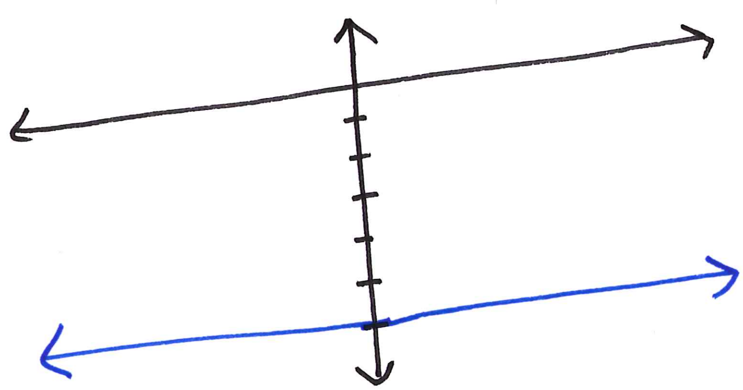
1. Vertical line $\Rightarrow$ x-coordinate stays fixed when y-coordinate changes. Since $(3,-7)$ is on the line, the equation must be

$$x = 3$$



2. Horizontal line $\Rightarrow$ y-coordinate stays fixed as x-coordinate changes. Since $(-1,-6)$ is on the line the equation must be

$$y = -6$$

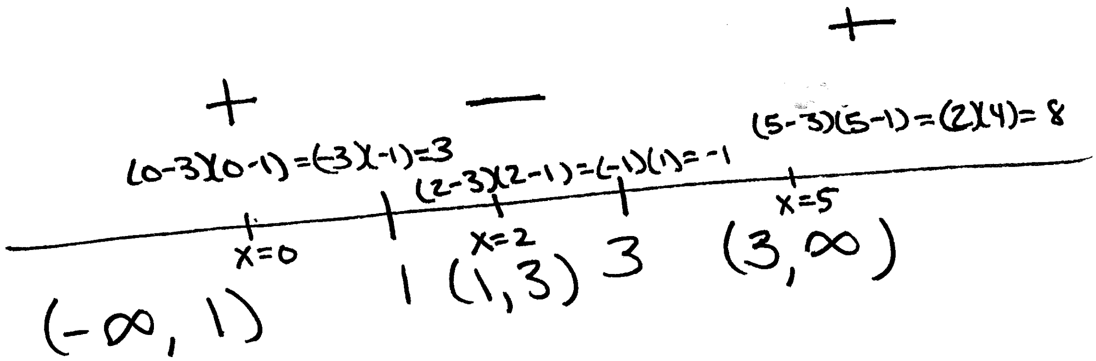


3. $x^2 - 4x + 3 = 0$

$(x-3)(x-1) = 0$

$x - 3 = 0 \quad x - 1 = 0$

$\boxed{x = 3 \qquad x = 1}$



$x^2 - 4x + 3$ is positive on

$(-\infty, 1) \cup (3, \infty)$

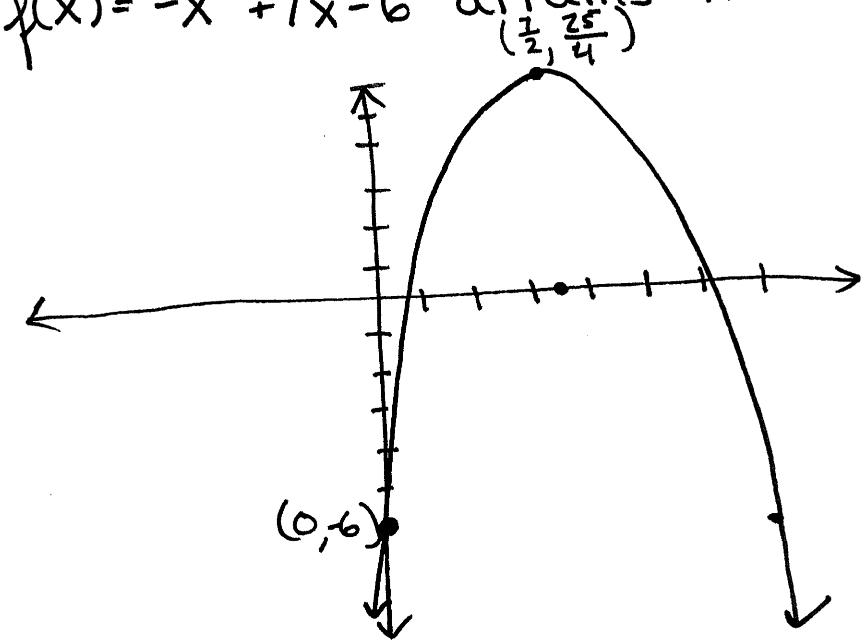
and is negative on

$(1,3)$

4. $f(x) = -x^2 + 7x - 6$ attains it maximum at $x = -\frac{b}{2a}$

$= \frac{-7}{2(-1)}$

$= \frac{7}{2}$



5. $f(x) = \begin{cases} \dfrac{x+4}{x^2-14x+45} & 3 \le x \le 7 \\ 2x-2 & x > 7 \end{cases}$

$x^2-14x+45 = (x-9)(x-5) = 0$

$x-9=0 \qquad x-5=0$

$x=9 \qquad x=5$

$\uparrow$

$x=5$ is not in domain since division by zero is not allowed.

Domain: $[3,5) \cup (5,\infty)$

6. Solve

$$4^{x^2-6} = \frac{1}{4^{5x}}$$

$$4^{x^2-6} = \frac{1}{4^{5x}} \Leftrightarrow 4^{x^2-6} = 4^{-5x}$$

$$\Leftrightarrow x^2-6 = -5x$$

$$\Leftrightarrow x^2+5x-6 = 0$$

$$\Leftrightarrow (x+6)(x-1) = 0$$

$$\boxed{x = -6 \quad \text{or} \quad x = 1}$$

7. Solve

$$\frac{5^{2x^2}}{5^{3x}} = \frac{1}{5}$$

$$\Leftrightarrow \quad 5^{2x^2} \cdot 5^{-3x} = 5^{-1}$$

$$\Leftrightarrow \quad 5^{2x^2-3x} = 5^{-1}$$

$$\Leftrightarrow \quad 2x^2-3x = -1$$

$$\Leftrightarrow \quad 2x^2-3x+1 = 0$$

$$(2x-1)(x-1) = 0$$

$2x-1=0$ $\Rightarrow 2x=1$ $\Rightarrow x=\frac{1}{2}$

$x-1=0$ $\Rightarrow x=1$

8. Solve

$$3^{x^2+4} = \frac{1}{3^{4x}}$$

$$3^{x^2+4} = \frac{1}{3^{4x}} \Leftrightarrow 3^{x^2+4} = 3^{-4x}$$

$$\Leftrightarrow x^2+4 = -4x$$

$$\Leftrightarrow x^2+4x+4=0$$

$$\Leftrightarrow (x+2)(x+2)=0$$

$$\boxed{x=-2}$$

9. $P = \dfrac{F}{(1+\frac{r}{m})^{m\cdot t}}$

$$\left.\begin{aligned} F &= \$100{,}000 \\ r &= 3.7\% = .037 \\ m &= 365 \\ t &= 10 \end{aligned}\right\} P = \frac{100000}{\left(1+\frac{.037}{365}\right)^{365\cdot 10}}$$

10. Solve for x:

$$\log(x-4) - \log(x-3) = \log x$$

$$\log\left(\frac{x-4}{x-3}\right) = \log x$$

$$\frac{x-4}{x-3} = x$$

$$x-4 = x(x-3)$$

$$x-4 = x^2-3x$$

$$x^2-3x-x+4=0$$

$$x^2-4x+4=0$$

$$(x-2)(x-2)=0$$

$x=2$ but $x=2$ is not in the domain of the original function since negatives are not allowed in logs

$\log(2-4) = \log(-2)$ for example

NO SOLUTIONS

11a. $\lim_{x\to 0} \frac{x^2+3x+3}{x^2+x}$ does not exist

$\lim_{x\to 0} x^2+3x+3 = 0^2+3(0)+3=3$

$\lim_{x\to 0} x^2+x = 0^2+0$

$\lim_{x\to 0^-} \frac{x^2+3x+3}{x^2+x} = -\infty$

$\lim_{x\to 0^+} \frac{x^2+3x+3}{x^2+x} = \infty$

b. $\lim_{x\to 1} (x^4+x^2+3) = 1^4+1^2+3=5$

c. $\lim_{x\to -1} \frac{x+1}{x^2-2x+1} = \lim_{x\to -1} \frac{x+1}{(x-1)(x-1)} = \frac{-1+1}{(-2)(-2)} = \frac{0}{4} = 0$

d. $\lim_{x\to -1} (x^5+x^2-1) = (-1)^5+(-1)^2-1 = -1+1-1 = -1$

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

(a) Instantaneous Rate of Change

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

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

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

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

$$= \lim_{h\to 0} \frac{h(4+2h)}{h}$$

$$= \lim_{h\to 0} 4+2h = 4$$

(b) At $x=1$, $f(1)=2(1)^2-3=2-3=-1$

$y-(-1)=4(x-1)$

$y+1=4(x-1)$

$y+1=4x-4$

$\boxed{y=4x-5}$

13. $f(x) = 0.5x^3 + 5x - 10$

a. Average Rate of Change $= \dfrac{f(4)-f(2)}{4-2}$

$$= \frac{0.5(4)^3 + 5(4) - 10 - (0.5(2)^3 + 5(2) - 10)}{2}$$

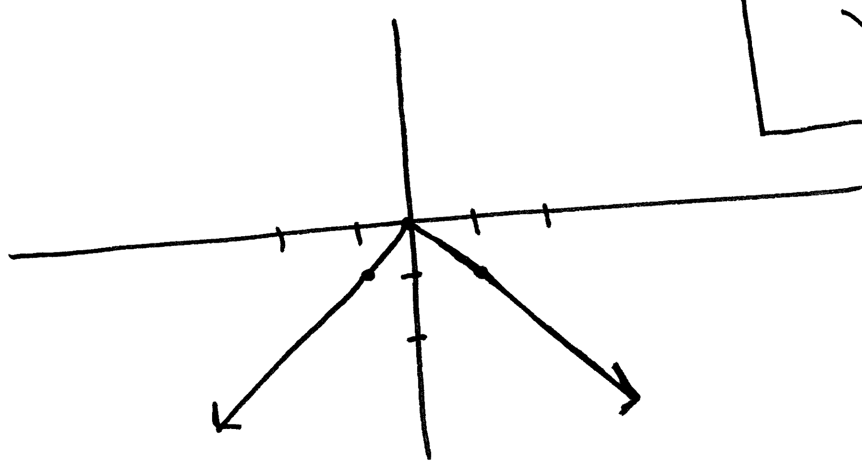
$$= \frac{0.5(64) + \cancel{20} - \cancel{10} - (0.5(8) \cancel{+10} - \cancel{10})}{2}$$

$$= \frac{32 + 10 - 4}{2}$$

$$= \frac{38}{2} = 19$$

$$\boxed{\begin{array}{l} \text{b. } f(2) = 4 \\ \text{Slope} = 19 \\ y - 4 = 19(x-2) \\ y - 4 = 19x - 38 \\ y = 19x - 34 \\ \text{y-intercept } (0, -34) \end{array}}$$

14.



$f(x) = -|x|$ is not differentiable at $x=0$

(this is a corner on the graph)

15. $f'(x) = \lim_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

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

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

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

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

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

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

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

$$= \frac{-1}{(x+0+2)(x+2)}$$

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