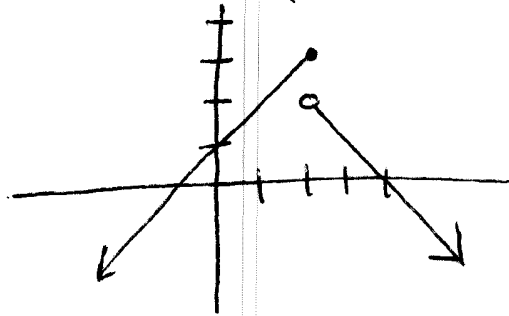


TO RECEIVE CREDIT YOU MUST SHOW YOUR WORK.

1. (10) Graph the function  $f(x) = \begin{cases} x+1 & \text{for } x \leq 2, \\ -x+4 & \text{for } x > 2. \end{cases}$



2. (5) Let  $f(x) = \frac{x-2}{x+1}$  and  $g(x) = \frac{x+3}{x-1}$ . Express  $f(x) + g(x)$  as a rational function

$$f(x) + g(x) = \frac{x-2}{x+1} + \frac{x+3}{x-1} = \frac{(x-2)(x-1) + (x+3)(x+1)}{(x+1)(x-1)} = \frac{2x^2 + x + 5}{x^2 - 1}$$

3. (10) Find the point of intersection of  $y = x^2 + 3x - 4$  and  $y = 5x + 11$ .

$$x^2 + 3x - 4 = 5x + 11$$

$$x^2 - 2x - 15 = 0$$

$$(x-5)(x+3) = 0$$

$$x = 5 \text{ or } x = -3$$

So the points of intersection are

$(5, 36)$  and  $(-3, -4)$

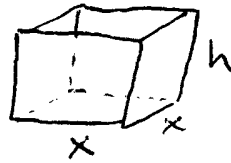
4. (5) Simplify  $\frac{(8x^2y)^{2/3}}{x^{1/3}y^{5/3}} = \frac{8^{2/3} x^{4/3} y^{4/3}}{x^{1/3} y^{5/3}}$

$$= \frac{4x}{y}$$

5. (10) Consider an open rectangular box with a square base.

a) Assign letters to the dimensions.

Let  $x =$  length of base  
 $h =$  height



b) Write an expression for the volume in terms of the variables

$$V = x^2 h$$

6. (10) Write the equation for the line that passes through the points  $(-1, 7)$  and  $(3, -2)$ .

$$m = \frac{7 - (-2)}{-1 - 3} = \frac{9}{-4}$$

$$y - 7 = -\frac{9}{4}(x + 1)$$

7. (10) Let  $f(x) = x^2 - 5x + 7$ . Find  $f'(x)$ , using the limit definition of the derivative.

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{(x+h)^2 - 5(x+h) + 7 - (x^2 - 5x + 7)}{h} \\ &= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 5x - 5h + 7 - x^2 + 5x - 7}{h} \\ &= \lim_{h \rightarrow 0} \frac{2xh + h^2 - 5h}{h} = \lim_{h \rightarrow 0} (2x + h - 5) = \underline{\underline{2x - 5}} \end{aligned}$$

8. (10) a) Find  $\lim_{x \rightarrow 3} (2x^2 - 3x + 7)$

$$= 2(3)^2 - 3(3) + 7 = 2(9) - 9 + 7 = \underline{\underline{16}}$$

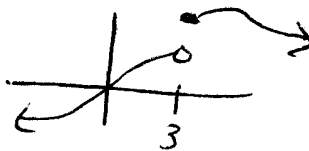
b) Find  $\lim_{x \rightarrow 2} \frac{x^2 - 2x}{x^2 - 7x + 10}$

$$= \lim_{x \rightarrow 2} \frac{x(x/2)}{(x-5)(x/2)} = -\frac{2}{3}$$

9. (5) Give an example of a function  $y = f(x)$  that is not continuous at  $x = 3$ .  
(Give the graph of the function or give the function using formulas.)

$$f(x) = \frac{1}{x-3}$$

or



[Infinitely many examples]

10. (15) Find the derivative of each of the following:

a)  $y = x^3 - 5x^2 + 7x - 3$

$$y' = 3x^2 - 10x + 7$$

b)  $f(x) = \frac{4x^2}{9} - \frac{3}{2x^2}$        $f(x) = \frac{4}{9}x^2 - \frac{3}{2}x^{-2}$

$$f'(x) = \frac{8}{9}x + 3x^{-3}$$

c)  $y = (x^3 + 8x)^6$

$$y' = 6(x^3 + 8x)^5 \cdot (3x^2 + 8)$$

11. (10) Write the equation of the tangent line to  $y = f(x) = x^3 - 2x + 1$  at  $x = 2$ .

point is  $(2, f(2))$  or  $(2, 5)$

$$m = f'(2) \quad f'(x) = 3x^2 - 2$$

$$f'(2) = 10$$

eg:  $y - 5 = 10(x - 2)$