1 (12 points) Let $f(x) = x^2 - 5x$ and $g(x) = |3 - 2x|$

(a) (7 points) Simplify the expression $\dfrac{f(x+h) - f(x)}{h}$ far enough so that plugging in $h = 0$ would be allowed.

$2x + h - 5$

(b) (6 points) Find all solutions to the equation $g(x) = 3x - 7$.

The only solution is $x = 4$.

2 (13 points) Clovis and Isobel are standing on Broadway, 30 feet South of the intersection with Aloha St. Clovis starts walking North at a constant rate of 5 feet/second. When he reaches the intersection, he turns West and continues at the same speed down Aloha St. Isobel does not move.

(a) (7 points) Give a multi-part function for the distance between Clovis and Isobel as a function of time. Use units of feet and seconds.

$$d(t) = \begin{cases} 5t & \text{if } 0 \le t \le 6; \\ \sqrt{900 + 25(t-6)^2} & \text{if } t > 6. \end{cases}$$

(b) (6 points) When are they 50 feet apart?

The only answer that makes sense is $t = 14$ *seconds.*

3 (12 points) Tafu is sailing near a radar buoy which can detect anything within 9 km of the buoy. He starts sailing from a point 7 km West and 11 km North of the buoy. He sails South for one hour, then turns and sails East for 30 km.

He sails at a constant speed of 6 km/hr.

How much time was he within 9 km of the buoy?

The total time is $\dfrac{4\sqrt{2} + \sqrt{56} + 2}{6} \approx 2.52$ *hours.*

4 (12 points) Winfield is moving linearly in the xy-plane at a constant speed. He starts from the point $(3, -1)$ and moves along the line $y = -2x + 5$ at a speed of 3 units per second, heading toward the y-axis.

(a) (6 points) Write parametric equations for Winfield's location t seconds after starting.

The equations are

$$x = -\frac{3}{\sqrt{5}}\,t + 3, \;\; y = \frac{6}{\sqrt{5}}\,t - 1$$

(b) (6 points) At what time is Winfield closest to the origin?

The answer is $t = \dfrac{\sqrt{5}}{3} \approx 0.745$ *seconds.*