EXAM ONE ANSWERS/SOLUTIONS

1

(a) Don: $t = \frac{10}{\sqrt{3}} \approx 5.774$ seconds.

Ellen: $t = \frac{-3+\sqrt{409}}{2} \approx 8.612$ seconds.

(b) At $t = 3/2 = 1.5$ seconds.

(c) At $t = -3 + \sqrt{89} \approx 6.434$ seconds.

(d) The greatest distance is $9/8 = 1.125$ feet and it occurs at $t = 3/4 = 0.75$ seconds.

2

(a) The intersection points of the line $y = 3x$ and the circle $(x - 60)^2 + (y - 120)^2 = 20^2$ are $(40, 120)$ (which is the entrance point) and $(44, 132)$ (the point we want).

(b) For $t = \frac{15\sqrt{10}}{44} \approx 1.078$ seconds.

(c) The shortest distance that Frank gets to the streetlight is along a line perpendicular to his path. Thus the closest he gets to the light is at the intersection of his path $y = 3x$ with the perpendicular line through the point $S = (60, 120)$. Since Frank's line is $y = 3x$, the perpendicular line has slope $m = -1/3$. It goes through the center of the circle $S = (60, 120)$, so the equation of the perpendicular line is $y = -\frac{1}{3}x + 140$. The intersection of $y = 3x$ and $y = -\frac{1}{3}x + 140$ is $(x, y) = (42, 126)$. Thus Frank is closest to the streetlight at the point $(x, y) = (42, 126)$.

3

(a) The constant c is the stretch factor. In our case, a picture that was 8 units wide (from -4 to $+4$) has been "stretched" (compressed, really) to a picture that is 4 units wide (-1 to $+3$). Thus the stretch factor c is $1/2$. (Note: this was incorrect in some earlier versions!)

The constant d is the horizontal shift, which is 1 unit to the right. Thus $d = 1$.

(b) The function $f(x)$ is given by

$$y = f(x) = \begin{cases} 8 - \sqrt{16 - x^2} & \text{if } -4 \le x \le 0 \\ 4 - x & \text{if } 0 < x \le 4. \end{cases}$$

Thus the domain is $\{x : -4 \le x \le 4\}$.