1. Find all values of $x$ in the interval $[0, 2\pi]$ that satisfy $\cos(2x) = -\cos x$.

2. Find all values of $x$ in the interval $[0, \pi]$ that satisfy the inequality $2 \cos(2x) + 1 < 0$.

3. Two cables extend from the top $P$ of a pole to points $B$ and $C$ on the ground, where $C$ is 10 ft closer to the pole than $B$. If $PB$ forms an angle of $35^\circ$ with the ground and $PC$ forms an angle of $65^\circ$ with the ground, what is the height of the pole? (You may use the approximations $\tan 65^\circ \approx 2.1$ and $\tan 35^\circ \approx 0.7$.)

4. Find a formula for the function $f$ graphed below.

5. The table below shows the price $p$ in dollars for mailing a first-class letter weighing $x$ ounces.

<table>
<thead>
<tr>
<th>weight ($x$)</th>
<th>price ($p$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>not over</td>
<td></td>
</tr>
<tr>
<td>1 oz</td>
<td>0.47</td>
</tr>
<tr>
<td>2 oz</td>
<td>0.68</td>
</tr>
<tr>
<td>3 oz</td>
<td>0.89</td>
</tr>
<tr>
<td>3.5 oz</td>
<td>1.10</td>
</tr>
</tbody>
</table>

(a) Express $p(x)$ as a function of the weight $x$ on the interval $0 < x \leq 3.5$.

(b) Sketch a graph of the function $p(x)$.

6. Suppose $f$ is an even function and $g$ is an odd function, and both functions are defined for all $x$. Are the following functions even, odd or neither? Justify your answers algebraically.

(a) $fg$          (b) $f/g$          (c) $g^2$          (d) $f \circ g$          (e) $g \circ g$

More problems on the next page
7. A balloon rising straight up from the ground is tracked by a range finder located 70 meters from the lift-off point.

(a) Suppose the line from the range finder to the balloon forms an angle of $\theta$ radians with the ground. Express the balloon’s height $h$ as a function of $\theta$.

(b) Let $s$ equal the distance between the range finder and the balloon. Express $s$ as a function of $h$.

(c) Now express $s$ as a function of $\theta$.

8. The Heaviside function $H$ is defined by

$$H(t) = \begin{cases} 0 & \text{if } t < 0 \\ 1 & \text{if } t \geq 0 \end{cases}$$

It is used in the study of electric circuits to represent the sudden surge of electric current, or voltage, when a switch is instantaneously turned on. The Heaviside function can be used to define the ramp function $y = ctH(t)$, which represents a gradual increase in voltage or current in a circuit.

(a) Sketch the graph of the ramp function $y = tH(t)$.

(b) Sketch the graph of the voltage $V(t)$ in a circuit if the switch is turned on at time $t = 0$ and the voltage is gradually increased to 96 volts over a 32-second time interval. Write a formula for $V(t)$ in terms of $H(t)$ for $t \leq 32$.

(c) Sketch the graph of the voltage $V(t)$ in a circuit if the switch is turned on at time $t = 8$ seconds and the voltage is gradually increased to 120 volts over a period of 24 seconds. Write a formula for $V(t)$ in terms of $H(t)$ for $t \leq 32$. 