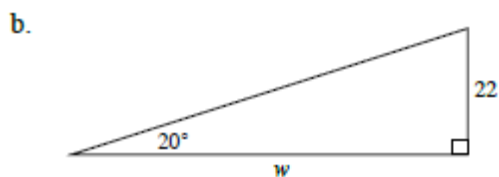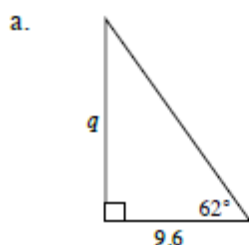## Example 2

Write an equation and use the tangent button on your calculator rather than your Trig Table Toolkit, to calculate the missing side length in each triangle.

a.

b.

When using the tangent button on a calculator with these problems, you must be sure that the calculator is in degree mode and not radian mode. Student should be able to check this and fix it, if necessary. Since we found that the slope ratio depends on the angle, we can use the angle measure and the tangent button on the calculator to find unknown lengths of the triangle.

In part (a), we know that the tangent of the angle is the ratio $\frac{\text{opposite leg}}{\text{adjacent leg}} = \frac{\Delta y}{\Delta x}$. This allows us to write the equation at right and solve it. Using a calculator, the value of "tan 62°" is ≈ 1.88.

$$\tan 62° = \frac{q}{9.6} \left(\frac{\text{opposite leg}}{\text{adjacent leg}} \right)$$

$$9.6(\tan 62°) = q$$

$$q \approx (9.6)(1.88) \approx 18.05$$

In part (b) we will set up another equation similar to the previous one. This equation is slightly different from the one in our first example in that the variable is in the denominator rather than the numerator. Some students might realize that they can rotate the triangle and use the 70° angle (which they would have to determine using the sum of the measures of the angles of the triangle) so that the unknown side length is in the numerator.

$$\tan 20° = \frac{22}{w}$$

$$w \tan 20° = 22$$

$$w = \frac{22}{\tan 20°}$$

$$w \approx 60.44$$

Example 3

Talula is standing 117 feet from the base of the Washington Monument in Washington, D.C. She uses her clinometer to measure the angle of elevation to the top of the monument to be 78°. If Talula's eye height is 5 feet, 3 inches, what is the height of the Washington Monument?
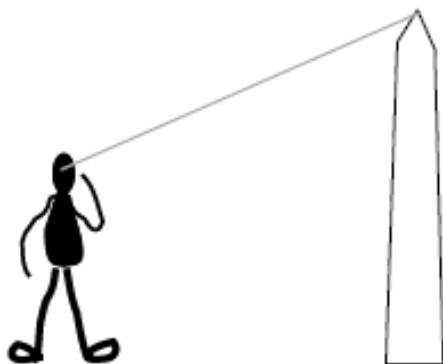
With all problems representing an everyday situation, the first step is the same: draw a picture of what the problem is describing. Here, we have Talula looking up at the top of a monument. We know how far away Talula is standing from the monument, we know her eye height, and we know the angle of elevation of her line of sight.

We translate this information from the picture to a diagram, as shown at right. On this diagram we include all the measurements we know. Then we write an equation using the tangent function and solve for x:
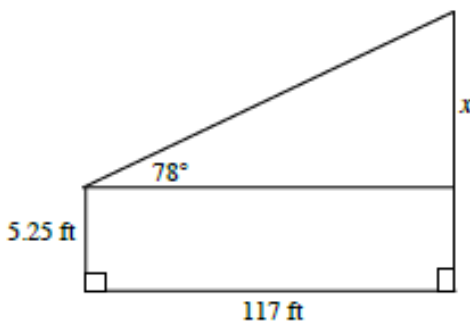
$$\tan 78° = \frac{x}{117}$$
$$117(\tan 78°) = x$$
$$x \approx 549.9 \text{ feet}$$

We add the "eye height" to the value of x to find the height of the Washington Monument:

$$549.9 + 5.25 \approx 555.15 \text{ feet}$$