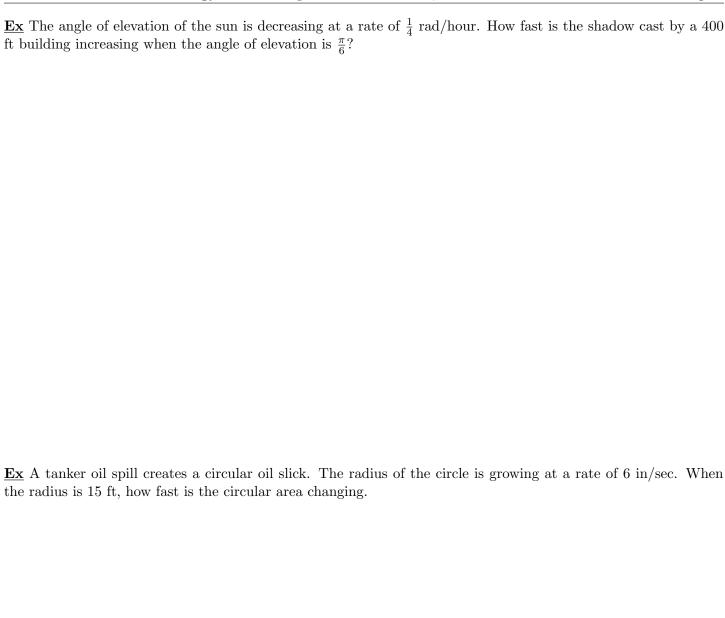
## Strategy for Solving Related Rates Problems:

0.	. Underline important quantiti	ies and relationships given.
1.	Draw a diagram, introduce notation, and label.	
	Label quantities that change in time with	
	Label quantities that are fixed (in time) with	
<b>2</b> .	Identify all relevant quantities.	
	Make a table of	described in words.
<b>3</b> .	Write down what is to be determined (unknown) and  Find when	what is given (known):
<b>4</b> .	Write down an equation that	·
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<b>5</b> .	Differentiate <b>both</b> sides of the equation	. Remember to use the chain rule!

Solve the following related rates problems by completing the steps 0-6 given above.

 $\underline{\mathbf{Ex}}$  A boat is pulled into a dock by a pulley that is 12 ft above the deck of a boat. If the winch pulls the rope in at a rate of 4 ft/sec, determine the speed of the boat when it is 5 ft from the dock.



$\mathbf{E}\mathbf{x}$	Α	6	ft	tall	man	walks	with	a s	speed	of	8 f	t/	$^{\prime}\mathrm{sec}$	awav	from	a street	light	on a	post	18 ft	t hi	igh.
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1. How fast is the tip of his shadow moving when he is 30 ft from the pole?

2. How would the problem change if you were asked to find how fast the length of the shadow is changing?

1. [Homework #14] If a snowball melts so that its surface area decreases at a rate of  $1 \text{ cm}^2/\text{min}$ , find the rate at which the diameter decreases when the diameter is 10 cm.

2. A person parachutes out of a plane. After the parachute opens, the parachutist begins falling at a constant rate of 14 miles per hour. The plane continues flying at a speed of 100 miles per hour. How fast is the distance between the parachutist and the plane increasing after the parachutist has fallen 0.2 miles and the plane has flown 1 mile past the drop site.

3. Sand is pouring from a pipe at the rate of  $120\pi$  ft<sup>3</sup>/s. The falling sand forms a conical pile on the ground. The altitude of the cone is always one-third the radius of its base. How fast is the altitude increasing when the pile is 20 ft high?