

# DO NOW

## Worksheet 4.7.2 Answers:

- 3 seconds
- $x = 15\sqrt{3}$ ;  $y = 20\sqrt{3}$
- 14 employees
- 6 in by 9 in
- 18 in by 36 in
- $(\frac{3\sqrt{2}}{2}, \frac{9}{2})$  and  $(-\frac{3\sqrt{2}}{2}, \frac{9}{2})$
- $x = -\sqrt{\frac{3}{2}}$ ,  $x = \sqrt{\frac{3}{2}}$
- 60 m by 120 m
- radius 3 in; height = 6 in

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## 4.7 Optimization Problems - Day 3

### Procedure:

- Identify all *given* quantities and quantities *to be determined*. If possible, make a sketch.
- Write a **primary equation** for the quantity that is to be maximized or minimized.
- Reduce the primary equation to one having a **single independent variable**. This may involve the use of **secondary equations** relating the independent variables of the primary equation.
- Determine the feasible domain of the primary equation.
- Find the derivative of the primary equation and find its critical number.
- Use the first and/or second derivative tests to determine the maximum or minimum. CLEARLY identify the appropriate answer(s).

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### Example:

7. An aquarium has a square base made of slate costing 8 cents per square inch and four glass sides costing 3 cents per square inch. The volume of the aquarium is to be 36,000 in<sup>3</sup>. Find the dimensions of the least expensive such aquarium.

$C = .08x^2 + .03(4xy)$   
 $C = .08x^2 + .12x(\frac{36,000}{x^2})$   
 $C = .08x^2 + \frac{12 \cdot 36,000}{x}$   
 $C = .08x^2 + \frac{4320}{x}$   
 $C' = .16x - \frac{4320}{x^2}$   
 $C' = \frac{.16x^3 - 4320}{x^2}$   
 $x^3 - 27,000 = 0$   
 $x^3 = 27,000$   
 $x = 30$

$V = x^2y = 36,000$   
 $y = \frac{36,000}{x^2}$   
 domain:  $x > 0$   
 $(0, 30) \mid (30, \infty)$   
 $f'(1) = - \mid f'(40) = +$   
 minimum  
**30 in x 30 in x 40 in**

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8. Missy Smith is at a point A on the north bank of a long straight river 6 miles wide. Directly across from her on the south bank is a point B, and she wishes to reach a cabin C located 6 miles down the river from B. Given that Missy can row at 6 mph and run at 10 mph, how far from point B should she land the boat and begin running?

$d = rt \Rightarrow t = \frac{d}{r}$   
 domain:  $0 \leq x \leq 6$   
 $t = \frac{\sqrt{x^2+36}}{6} + \frac{6-x}{10}$   
 $t' = \frac{1}{6} \cdot \frac{1}{2}(x^2+36)^{-1/2} \cdot 2x - \frac{1}{10}$   
 $t' = \frac{x}{6\sqrt{x^2+36}} - \frac{1}{10} = 0$   
 $\frac{x}{6\sqrt{x^2+36}} = \frac{1}{10}$  \* Cross multiply  
 $10x = 6\sqrt{x^2+36}$  Square both sides  
 $100x^2 = 36(x^2+36)$   
 $100x^2 = 36x^2 + 1296$   
 $64x^2 - 1296 = 0$   
 $64x^2 = 1296$   
 $4x^2 = 81$   
 $4x^2 - 81 = 0$   
 $x = \pm \frac{9}{2}$  ← reject negative  
**4.5 miles**

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# HOMEWORK

## Worksheet - HW 4.7.3

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