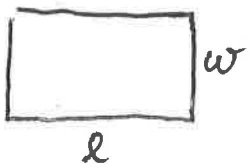
Quiz 4

Name: key Row:

[10] **1.** The length of a rectangle is increasing at 3 feet per second, and the width is decreasing in such a way that the area stays constant at 10 square feet. How fast is the width decreasing when the length is 5 feet?



$lw = 10$ 1

Find $\frac{dw}{dt}$ when $l = 5$ and $\frac{dl}{dt} = 3$. 1

$\frac{d}{dt}(lw) = \frac{d}{dt}(10)$ 1

2 $w \cdot \frac{dl}{dt} + l \cdot \frac{dw}{dt} = 0$ 1

When $l = 5$, $w = 2$, so 1

$2 \cdot 3 + 5 \cdot \frac{dw}{dt} = 0$, so

1 1

1

$\boxed{\frac{dw}{dt} = \frac{-6}{5} \text{ ft./sec.}}$

[10] **2.** Find the maximum and minimum values of $f(x) = 3x - 4x^3$ on the interval $[0, 2]$. Show all work.

Maximum value of $f(x)$ is 1 at $x = \frac{1}{2}$

Minimum value is $f(x)$ is -26 at $x = 2$

$f'(x) = 3 - 12x^2 = 0$ when $x^2 = \frac{3}{12}$ or $x = \pm\sqrt{\frac{1}{4}} = \pm\frac{1}{2}$.

2 2

The critical points of $f(x)$ are at $x = -\frac{1}{2}$ and $x = \frac{1}{2}$, but the only one of these in $[0, 2]$ is $x = \frac{1}{2}$. 2 So we check f at the endpoints $x = 0$ and $x = 2$, and the critical point $x = \frac{1}{2}$:

2

$f(0) = 0$

$f(\frac{1}{2}) = 3 \cdot \frac{1}{2} - 4 \cdot \frac{1}{8} = 1$

$f(2) = 3 \cdot 2 - 4 \cdot 8 = -26$

So the max is 1 at $x = \frac{1}{2}$ and the min is -26 at $x = 2$

2