Calculus Unit 3	Name _____
Average Rates & Values	Date _____
Practice #3	Period _____

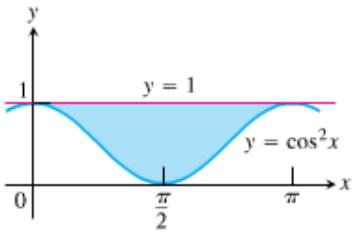
1. Find the average rate
2. Find the instantaneous rate
3. Find the area of the shape
4. Find the average value
5. State where that happens (x,y)

*Note: if you do not have access to a TI89 or wolfram, still write out the equation you would use to solve parts 4 & 5

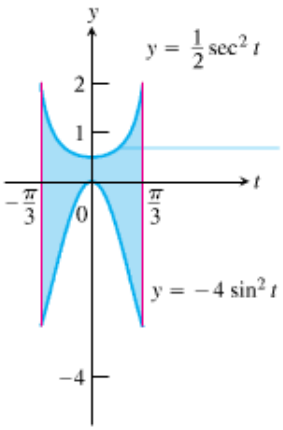
**Note: These shapes will push you to think. Even if you are not able to 'solve' the problem, describe your thinking about how to find average rates, values, etc.

In Exercises 1–6, find the area of the shaded region analytically.

1.



2.



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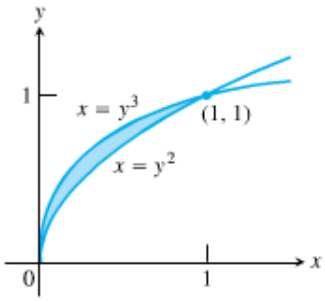
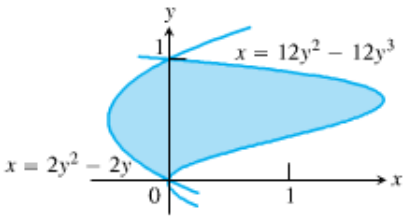


4.



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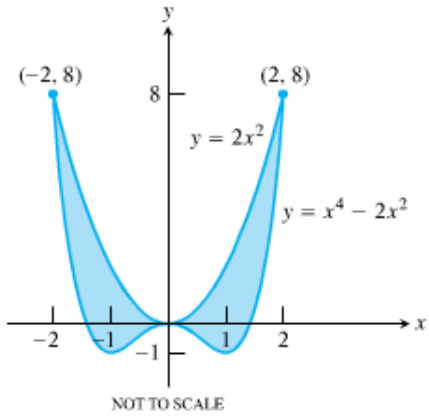
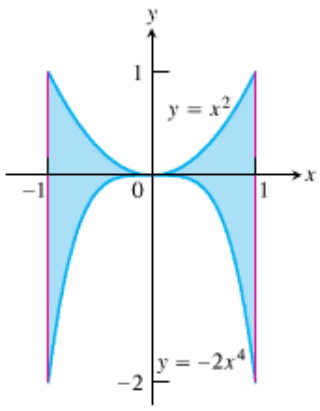


NOT TO SCALE

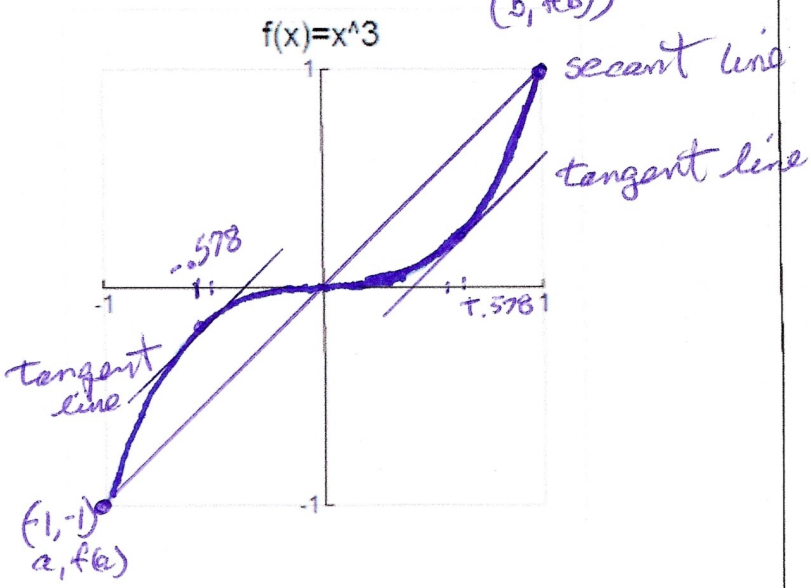
6.



Sample Problem:

imagine the following function: $f(x) = x^3$ for the interval $-1 \le x \le 1$

What does that look like graphically?



1. find average rate: MEAN VALUE THEOREM

$\frac{f(b)-f(a)}{b-a}$ = secant line = $\frac{1-(-1)}{1-(-1)} = \frac{2}{2} = 1$ slope of secant line is 1

2. find the instantaneous rate: find the point where slope is 1

$f(x) = x^3$

$f'(x) = 3x^2$ $\quad f'(c) = \frac{1}{3} = \frac{3x^2}{3}$

$\frac{1}{3} = x^2$ $\quad x = \pm\sqrt{\frac{1}{3}}$ $\quad x \approx \pm .578$

look at graph this makes sense. there are 2 places which have slope of 1!

3. find the area of the shape:

use $\int_{-1}^{1} x^3$ to find area. use WOLFRAM OR TI89 and type $\int_{-1}^{1}(x^3, x, -1, 1)$ hit enter area = 0

this makes sense, just as much + area and negative area, this shape is symmetrical about the x-axis.

4. find the average value:

$\frac{1}{b-a}\int_{-1}^{1} x^3$ and we saw area = 0 $\quad \frac{0}{1-(-1)} = \frac{0}{2} = 0$

now where does average value of 0 happen?

5. where does the happen (x,y):

again use wolfram or TI89 to solve

type this solve($x^3 = 0, x$) and hit enter

$x = 0$. again this makes sense, at (0,0) the average is same above and below.