Name: _____

CLASSWORK 114

1. Lily drips a drip of hot chocolate on her t-shirt. Because this is a math problem, the stain is a perfect circle. The radius of the circle is increasing at a rate of .75 in/s.

a) Find the rate of increase of the circular stain's circumference.

b) Find the rate of increase of the circular stain's area when its radius is .25 in.

2. A quartic (4th degree) function has a minimum at $x = -2$, a maximum at $x = 0$, and a minimum at $x = 6$. The function goes through the point (-3, 13). Find the equation of the function.

3. Lily decides that she is not making enough money teaching, so instead she starts working as a waitress at the Awesome Mathematics Restaurant. Her tips at the restaurant are constantly fluctuating depending on the time of day. In fact, the rate at which she is making tips varies according to the equation

$m = \sin t + 5$ where m is her rate of dollars per hour and t is time in hours.

a) How much is Lily making in tips, per hour, at t = 2 pm?

b) If Lily's tips were constant, how much money would she make between 2 pm and 3 pm?

c) Why isn't this the actual amount of money she made?

d) Calculate the actual amount of tips she earns between 2 pm and 3 pm.

4. Many countries, including the U.S., have progressive income tax. This means that you pay a higher percentage of tax the more money you make.

a) Let's say that in the U.S., you pay 0% tax on your first $10,000 of income. You pay 5% the next $10,000 of income, 15% on the next $20,000 of income, 20% tax on the next $20,000 of income, and 35% on any income beyond that.

Under this system, calculate the amount of tax owed by people with the following incomes:

i) $7,000

ii) $15,000

iii) $75,000

b) Newton-land has a progressive tax system that is based on a mathematical equation (surprise!) The rate of tax you pay on the **nth** dollar you earn is given by $\mathbf{R = \sqrt{\frac{N}{100{,}000}}}$

i) Find **rate** of tax on the $10,000th dollar (how many cents of it goes to the government)

ii) Find the rate of tax on the $75,000th dollar.

iii) Find the total amount of tax paid in Newton-land by a person who makes $75,000.

5. Find $\lim_{x \to 4} \frac{x^2 - 7x + 12}{x - 4}$

6. Find the derivative of each function.

a) $y = 10x^3 - 4x + 7$

b) $y = \ln x \cos x$

c) $y = \cos(4x^3 - \sin x)$

d) $y = \sqrt[4]{\ln x}$

7. Use the chart below to answer the following questions.

x	f(x)	f'(x)	g(x)	g'(x)	h(x)	h'(x)
1	-4	2	6	-1	5	-2
2	-5	12	3	-2	1	-3
3	2	-5	4	-1	8	5
4	3	2	1/2	-5	4	7
5	6	0	5	-1/2	2	-1/4

a) Let $P(x) = f(x)g(x)$.

i. Find P(3)

ii. Find P'(3)

iii. Find P'(4)

b) Let $C(x) = f(h(x))$

i. Find C(2)

ii. Find C'(1)

iii. Find C'(5)