Test #2 Review
Covers 3.1-3.11

Sec 3.1: Tangents and the Derivative at a Point

- ✓ Find the slope of a tangent line to a given curve
- ✓ Find the equation of the tangent line to a given curve
- ✓ Given the slope and the curve find the tangent line
- ✓ Know how a derivative is defined

Problems to try:

15.

#17 Find the slope of the function's graph at the given point. Then find an equation for the line tangent to the graph $f(x) = \sqrt{x}, (4,2)$

#19 Find the slope of the curve at the point indicated: $y = 5x^2, x = -1$

#25 Find the equations of all lines having slope -1 that are tangent to the curve $y = \frac{1}{x-1}$

#29 **Circle's changing area:** What is the rate of change of the area of a circle ($A = \pi r^2$) with respect to the radius when the radius is $r = 3$?

Sec 3.2: The Derivative as a Function

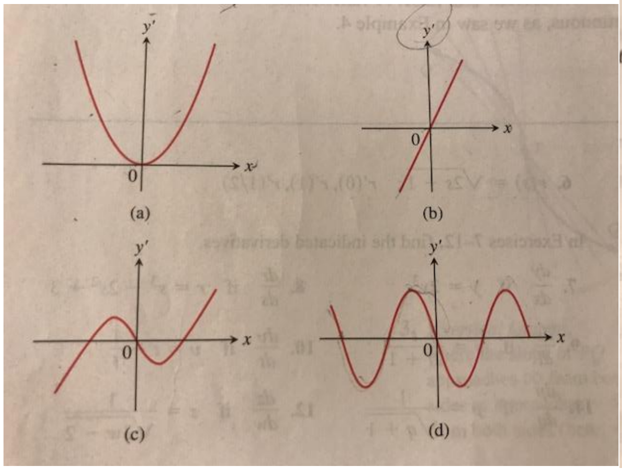
- ✓ Be able to draw f'(x) given f(x). We did a worksheet of this in class.
- ✓ Find f'(x) still using the definition of a derivative.
- ✓ Know the definition of differentiable
- ✓ Know the relationship between differentiable and continuous
- ✓ Be able to identify the f, f', f'', f''' from different graphs.
- ✓ Know where a graph is not differentiable and why.

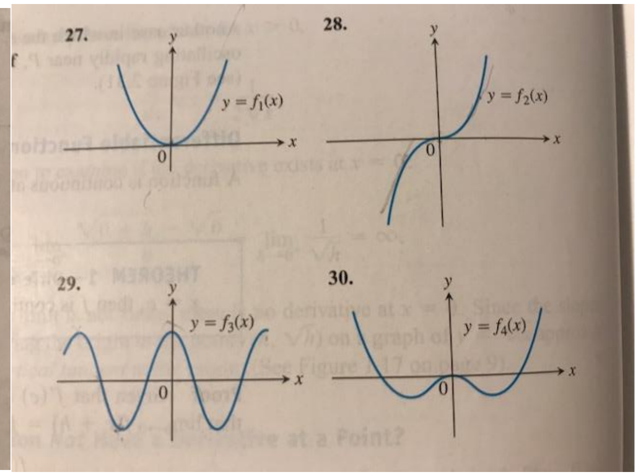
Problem to try:

1.

#9 Find the indicated derivative: $\frac{ds}{dt}$ if $s = \frac{t}{2t+1}$

#27-30 Match the functions graphed in Exercises 27-30 with the derivatives graphed in the accompanying figures (a)-(d).





1. T or F: If a function is differentiable at a point, it is also continuous at that point.
2. Explain why if a function f(x) has a "corner" at x = a, then f'(a) does not exist.
3. T or F: If a function f is continuous at a point c, then f is differentiable at c.

Sec 3.3-3.9:

- ✓ You **must** know all the derivative rules!!!!!!!!!!!!!!
- ✓ You **must** know all the derivative formulas!!!!!!!!!!!
- ✓ How to find a tangent line at a given point. Also be able to find a normal line to that tangent line.
- ✓ Be able to find multiple derivatives and what each derivative stands for (velocity, acceleration, jerk)
- ✓ Be able to prove certain rules using the definition of a derivative. For example prove the trig functions such as tanx using sinx and cosx.
- ✓ Know how to identify the composite functions and then apply the chain rule to find the derivative.
- ✓ Know how to use implicit differentiation. Remember that if you do happen to know what y = then you must substitute it back into the end result.
- ✓ Know how to use logarithmic differentiation. Remember the log rules that assist in that differentiation. Remember that if the x is the power you must use logarithmic differentiation to get to the x in the power.
- ✓ Know how to derive the lnx and ln g(x) formulas using implicit differentiation.

Problems to try: Because most of the sections used the same info, all the problems will be lumped together. Know when to use one rule instead of another.

4. Find the derivatives of the following functions:

#1 $y = x^5 + 0.125x^2 + 0.25x$

#3 $y = x^3 - 3(x^2 - \pi^2)$

#5 $y = (x+1)^2(x^2 + 2x)$

#7 $y = \left(\boldsymbol{\theta^2} + \boldsymbol{sec}(\boldsymbol{\theta}) + +\mathbf{1}\right)^{\mathbf{3}}$

#9 $s = \frac{\sqrt{t}}{1+\sqrt{t}}$

#11 $y = 2\tan^2 x - \sec^2 x$

#13 $s = \cos^4(1 - 2t)$

#15 $s = (\sec t + \tan t)^5$

#17 $r = \sqrt{2\boldsymbol{\theta sin}(\boldsymbol{\theta})}$

#19 $r = \sin\sqrt{2\boldsymbol{\theta}}$

#21 $y = \frac{1}{2}x^2 \csc\frac{2}{x}$

#23 $y = x^{-\frac{1}{2}}\sec(2x)^2$

#25 $y = 5\cot x^2$

#27 $y = x^2\sin^2(2x^2)$

#29 $s = \left(\frac{4t}{t+1}\right)^{-2}$

#31 $y = \left(\frac{\sqrt{x}}{1+x}\right)^2$

#33 $y = \sqrt{\left(\frac{x^2+x}{x^2}\right)}$

#35 $r = \left(\frac{\sin(\boldsymbol{\theta})}{\cos(\boldsymbol{\theta})-\mathbf{1}}\right)^{\mathbf{2}}$

#37 $y = (2x+1)\sqrt{2x+1}$

#39 $y = \frac{3}{(5x^2+\sin 2x)^{\frac{3}{2}}}$

#41 $y = 10e^{-\frac{x}{5}}$

#43 $y = \frac{1}{4}xe^{4x} - \frac{1}{16}e^{4x}$

#45 $y = \ln(\sin^2\boldsymbol{\theta})$

#47 $y = \log_2\left(\frac{x^2}{2}\right)$

#49 $y = 8^{-t}$

#51 $y = 5x^{3.6}$

#53 $y = (x+2)^{x+2}$

#55 $y = \sin^{-1}\sqrt{1-u^2}\,, 0 < u < 1$

#57 $y = \ln(\cos^{-1} x)$

#59 $y = t(\tan^{1} t) - \frac{1}{2}\ln(t)$

#61 $y = z(\sec^{-1} z) - \sqrt{z^2-1}, z > 1$

#63 $y = \csc^{-1}(\sec(\boldsymbol{\theta}))\,, 0 < \boldsymbol{\theta} < \frac{\pi}{2}$

5. T or F: The 427th derivative of sinx is –cosx.
6. What is (fgh)''
7. Find the equation of the tangent line to the function at a given point for the following three separate problems:

   $y = \sqrt[3]{x} + e^{1-x}$ at x = 1

   $xe^{y} = y - 1$ at (0,1)

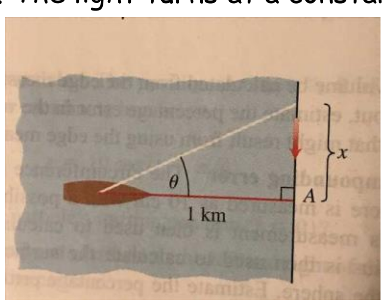
   $y = x - x^2$ at (1,0)

Sec 3.10: Related Rates

- ✓ Computing the rate of change of one quantity in terms of the rate of change of another quantity.
- ✓ Derivatives are found with respect to time.
- ✓ General information is true at every instant of time. Specific information is true at a specific instant of time.

Problems to Try:

8. See problems from class that are on the I-learn site.
9. Gravel is being dumped from a conveyor belt at a rate of 30 cubic ft/min, and its coarseness is such that it forms a pile in the shape of a cone whose base diameter and height are always equal. How fast is the height of the pile increasing when the pile is 10 ft high?
10. **Moving Searchlight Beam**: The figure shows a boat 1 km off-shore, sweeping the shore with a searchlight. The light turns at a constant rate, $\frac{d\boldsymbol{\theta}}{dt} = -0.6$rad/sec.



   a. How fast is the light moving along the shore when it reaches point A.

   b. How many revolutions per minute is 0.6 rad/sec?

Sec 3.11: Linear Approximation and Differentials

- ✓ Finding the linearization is just finding the tangent line: $L(x) = f(a) + (x-a)f'(a)$
- ✓ Find a differential

Problems to Try:

11. Find the linearization $L(x)$ of $f(x)$ at $x = a$ for problems 2 and 5

#2 $f(x) = \sqrt{x^2 + 9}, a = -4$

#5 $f(x) = \tan x\,, a = \pi$

Find dy for problems 23 and 37

#23 $2y^{\frac{3}{2}} + xy - x = 0$

#37 $y = \sec^{-1}(e^{-x})$

#39

Find the change $\Delta f = f(x_0 + dx) - f(x_0)$, The value of the estimate $df = f'(x_0)dx$, and the approximation error $|\Delta f - df|$. When $f(x) = x^2 + 2x, x_0 = 1, dx = 0.1$