Math 90 Practice Midterm III
Ch. 8-10 (Ebersole), 3.3-3.8 (Stewart)

DISCLAIMER. This collection of practice problems is *not* guaranteed to be identical, in length or content, to the actual exam. You may expect to see problems on the test that are not exactly like problems you have seen before.

On the actual exam you will see directions similar to these:

1. Please read directions carefully. Raise your hand if you are not sure what a problem is asking.
2. *You must explain your work thoroughly and unambiguously to receive full credit,* except *on questions or parts of questions designated as* ***Multiple Choice****,* ***Fill-In****, or* ***Graph****.*
3. **No calculators or notes are allowed on this exam.**
4. You have 50 minutes to complete your test, unless announced otherwise. Do not spend too long on any one problem. You do not have to do the problems in order. Do the easy ones first. Do not attempt the bonus question until you have completed the rest of the test. Before turning in your test, please make sure you have answered and double-checked all the questions.
5. If you need scratch paper, please raise your hand. You may not use your own paper. When you have finished your exam, please turn in any scratch paper you use.
6. Write your solutions in the space provided for each problem, or provide specific instructions as to where your work is to be found. *Make it clear what you want and don't want graded.* Your final answers should be boxed or circled.
7. Don't stress! I'm rooting for you!

True or False. Circle **T** if the statement is *always* true; otherwise circle **F**.

1. If $f(x) = 3x^4 - 2x + 1$, then $f''(x) = 12x^3 - 2$. **T** **F**
2. If $g(x) = (5x^2 + 1)(4x - 2)$, then $g'(x) = (10x)(4)$. **T** **F**
3. $\sec\theta \tan\theta = \frac{\sin\theta}{\cos^2\theta}$ for all angles θ. **T** **F**
4. $\sin(5t) = 5\sin t$ for all angles t. **T** **F**
5. $\tan\left(\frac{2\pi}{3}\right) = -\sqrt{3}$. **T** **F**
6. The only solution to the equation $\cos t = -1$ is $t = \pi$. **T** **F**
7. $\frac{d}{dt}(\cos(3t^2 + 1)) = -\sin(6t)$. **T** **F**
8. If $3x^2y = \tan(y^2)$, then $\frac{dy}{dx} = \frac{-6xy}{3x^2 - 2y\sec^2(y^2)}$. **T** **F**

Multiple Choice. *Circle the letter of the best answer.*

1. If $f(x) = \tan x$, then $f''(x) =$

   (a) $\frac{2\sin x}{\cos^3 x}$

   (b) $\frac{1}{\sin^2 x}$

   (c) $\sec^2 x$

   (d) $2\sec x \tan x$

2. $\dfrac{d}{dx}\left(\dfrac{x}{x-1}\right) =$

   (a) $-\frac{x}{(x-1)^2}$

   (b) 1

   (c) $-\frac{1}{(x-1)^2}$

   (d) $\frac{1}{(x-1)^2}$

3. If $x^2 - y^2 = 4$, then $\frac{dy}{dx} =$

   (a) $\frac{y}{x}$

   (b) $-\frac{y}{x}$

   (c) $\frac{x}{y}$

   (d) $-\frac{x}{y}$

4. If $f(x) = \sqrt[5]{x^2+1}$, then $f'(x) =$

   (a) $\frac{1}{5}(x^2+1)^{-4/5}$

   (b) $\dfrac{2x}{5(x^2+1)^{4/5}}$

   (c) $\dfrac{2x}{5(x^2+1)^{2/5}}$

   (d) $\frac{1}{5}x(x^2+1)^{-2/5}$

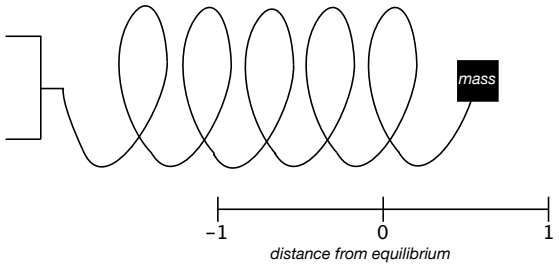
5. A mass attached to the end of a spring is pulled and then released. t seconds after release, the distance of the mass from equilibrium is $s(t) = \cos 2\pi t$ centimeters. The acceleration of the mass after 3 seconds is

   (a) 0 cm/s^2

   (b) -4π cm/s^2

   (c) $-4\pi^2$ cm/s^2

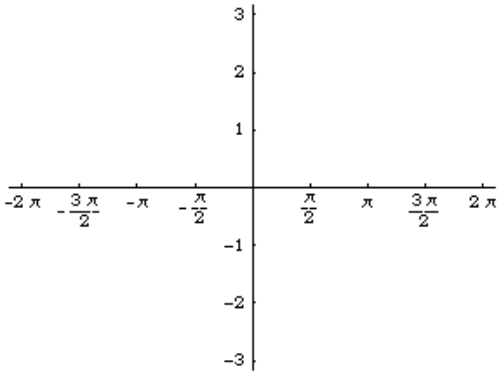
   (d) -2π cm/s^2



Graph.

On the axes at right, sketch a graph of the function $f(t) = \frac{3}{2}\sin 2t$.

More accuracy = more points!



Fill-In.

1. $\sin\left(\frac{3\pi}{2}\right) =$ _____

2. $\cos\left(\frac{3\pi}{4}\right) =$ _____

3. $\tan\left(\frac{11\pi}{6}\right) =$ _____

4. $\sec\left(\frac{17\pi}{3}\right) =$ _____

5. If $\cos\theta = -\frac{1}{5}$ and θ is in quadrant II, then
   (a) $\sin\theta =$ _____
   (b) $\tan\theta =$ _____
   (c) $\sec\theta =$ _____
   (d) $\csc\theta =$ _____
   (e) $\cot\theta =$ _____

6. If $f(-3) = 4$, $f'(-3) = 1$, $f'(2) = 5$, $g(-3) = 2$, and $g'(-3) = -1$, then
   (a) $(f \circ g)'(-3) =$ _____
   (b) $(fg)'(-3) =$ _____

Work and Answer. *You must show all relevant work to receive full credit.*

1. If $f(x) = 4x^{1/3} - \cos x + \frac{1}{\sqrt{x}}$, find $f'(x)$.

2. Find the slope of the tangent line to the graph of $\frac{(x+2)^2}{9} + \frac{y^2}{4} = 1$ at the point $(-2, 2)$.

3. If a stone is thrown vertically upward from the surface of the moon with a velocity of 10 m/s, then its height (in meters) after t seconds is $s(t) = 10t - 0.83t^2$.

   (a) What is the velocity of the stone after 3 seconds?

   (b) What is the acceleration of the stone after 3 seconds?

   (c) When does the stone reach its maximum height?

4. Find the equation of the tangent line to the graph of $h(x) = \sqrt{5x^2 + 4}$ at $x = 3$.

Some kind of **BONUS.**