

Test 2 Practice — October 2009
Math 113

- You may use one 3x5 card with notes (both sides, if you wish). Calculators or computers are not allowed.
 - The actual test will be comparable in length to test 1.
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- (1) Find all points on the curve $x^2 + \frac{y^2}{4} = 25$ where the tangent line has slope -1 .
- (2) A train is traveling west at 120 feet per second down a straight track. There is a utility pole 40 feet from the track, and the train's headlight casts a shadow of the pole on a wall that is 60 feet west of the pole and perpendicular to the track. How fast is the shadow moving when the front of the train is 30 feet east of the pole?
- (3) Find the 2nd-order Taylor polynomial for $\ln x$ at $x = 1$.
- (4) Identify where the function $f(x) = xe^x$ is increasing/decreasing and concave up/down, and use that information to sketch the graph.
- (5) You have 1 meter of wire. You are going to cut the wire into two pieces, and form two squares. What should the lengths be in order to maximize the sum of the areas of the two squares?
- (6) (a) For $a > 0$, find a formula for $\frac{d}{dx}(a^x)$.
(b) For (fixed) $x > 0$, find $\lim_{r \rightarrow 0} \frac{x^r - 1}{r}$. (Be careful: since this is a limit as $r \rightarrow 0$, we are treating r as our variable and x as a constant.)
- (7) A spigot on a tank of water is opened, and water drains out at a rate of $12 - t$ gallons/minute (where $t = 0$ is the moment the spigot was opened), until the tank is empty after 12 minutes. How much water was in the tank?
- (8) Find the following integrals. (Note: $\int \cos x dx = \sin x + C$; $\int \cos x dx = \sin x$ would not receive full credit.)
 - (a) $\int (x^3 - 3x + \frac{3}{x} - \frac{1}{x^3}) dx$
 - (b) $\int \left(\frac{1}{\sqrt{1-x^2}} - \frac{\pi}{x^2} \right) dx$
 - (c) $\int \frac{1 + \sin t}{\cos t} dt$
 - (d) $\int_0^5 \sqrt[3]{y}(y^2 + 1) dy$
- (9) Are the following correct or not?
 - (a) $\int \frac{x^2}{1+x^2} dx = x - \tan^{-1} x + C$
 - (b) $\int \frac{x}{1+x^2} dx = \ln(1+x^2) + C$