What's on your test?

1) Derivatives of: $\ln x$, e^x, $\log_a x$, a^x, x^x, inverse functions, all 6 trig functions, all 6 inverse trig functions

2) Integrals of: $1/x$, e^x, a^x, all 6 trig functions, expressions whose answers are inverse trig functions

3) applications including: exponential growth/ decay, slope fields, differential equations including domain

December 15, 2016

1) Find $\frac{dy}{dx}$ if $y = \ln \sqrt[3]{\frac{x-1}{x+1}}$ ✓ $\frac{dy}{dx} = \frac{1}{3(x-1)} - \frac{1}{3(x+1)}$ *or* $\frac{2}{3(x-1)(x+1)}$

2) Find $\frac{dy}{dx}$ if $y = x^5 e^{x^4}$ ✓ $\frac{dy}{dx} = e^{x^4}(5x^4 + 4x^8)$

3) Find $\frac{dy}{dx}$ if $y = 9^{x^4}$ ✓ $\frac{dy}{dx} = 4x^3(\ln 9)(9^{x^4})$

4) Find $\frac{dy}{dx}$ if $y = \log_8\left(\frac{x^2-10}{x-6}\right)$ ✓ $\frac{dy}{dx} = \frac{2x}{(x^2-10)(\ln 8)} - \frac{1}{(x-6)(\ln 8)}$ *or* $\frac{x^2-12x+10}{(x^2-10)(x-6)(\ln 8)}$

5) Find $\frac{dy}{dx}$ if $y = \frac{\sin x - \cot x}{\cos x}$ ✓ $\frac{dy}{dx} = \sec^2 x + \csc x \cot x$

6) Find $\frac{dy}{dx}$ if $y = 7\arcsin(10x^2 + 15x - 6)$ ✓ $\frac{dy}{dx} = \frac{7(20x+15)}{\sqrt{1-(10x^2+15x-6)^2}}$

7) $\int 6x^3 e^{-x^4} dx$ $= -\frac{3}{2} e^{-x^4} + C$

8) $\int 3(7^{-5x}) dx$ $= \frac{(-3)(7^{-5x})}{5 \ln 7} + C$

9) $\int 3 \sec(4x)\, dx$ $= \frac{3}{4} \ln|\sec(4x) + \tan(4x)| + C$

10) $\int \frac{x-3}{x^2+1} dx$ $= \frac{1}{2} \ln(x^2 + 1) - 3 \arctan x + C$

The rate of change of V is proportional to 80 - V.

a) Write the differential equation that models the situation. Then find the general solution for V in terms of C, k and t.

✓ $\frac{dV}{dt} = k(80 - V)$

✓ $V = 80 - Ce^{-kt}$

b) If V = 20 when t = 0, and V = 50 when t = 5, rewrite your equation for V in terms of t.

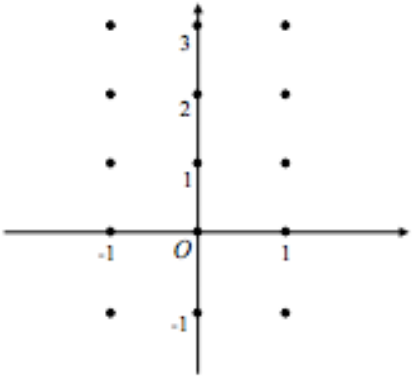
✓ $V = 80 - 60e^{\left(\frac{1}{5}\ln\left(\frac{1}{2}\right)\right)t}$

c) How long will it take for V to equal 70?

✓ $t \approx 12.9248$

2. Consider the differential equation $\frac{dy}{dx} = x^2(y-1)$.

a) On the axes below, sketch a slope field for the given differential equation at the fifteen points indicated.



b) Find the particular solution, $y = f(x)$ to the given diff. equation with the initial condition $f(0) = 3$ and state its domain.

c) Find the equation of the line tangent to $y = f(x)$ at the point where $x = 0$ and use it to approximate $f(0.1)$.

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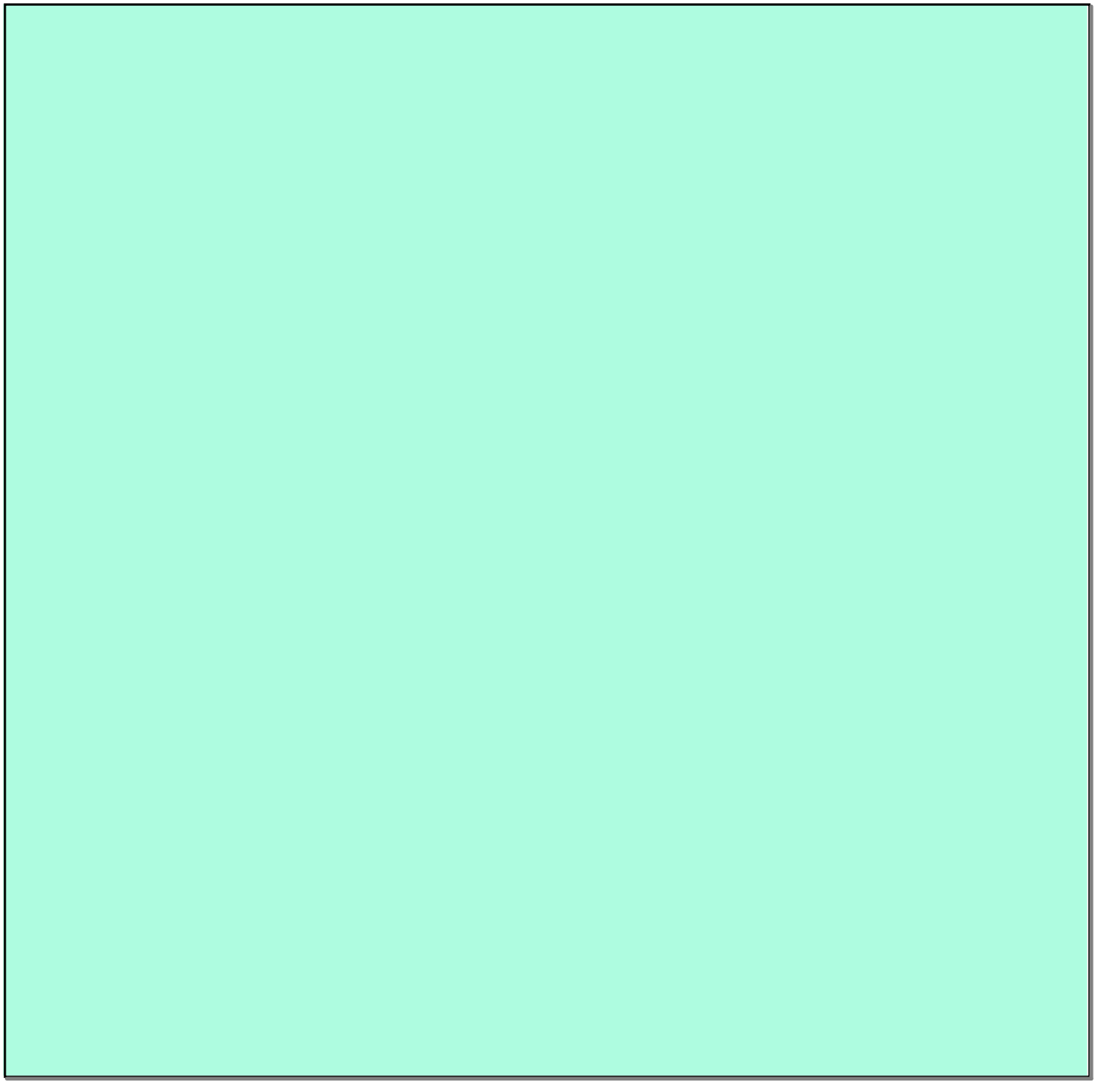

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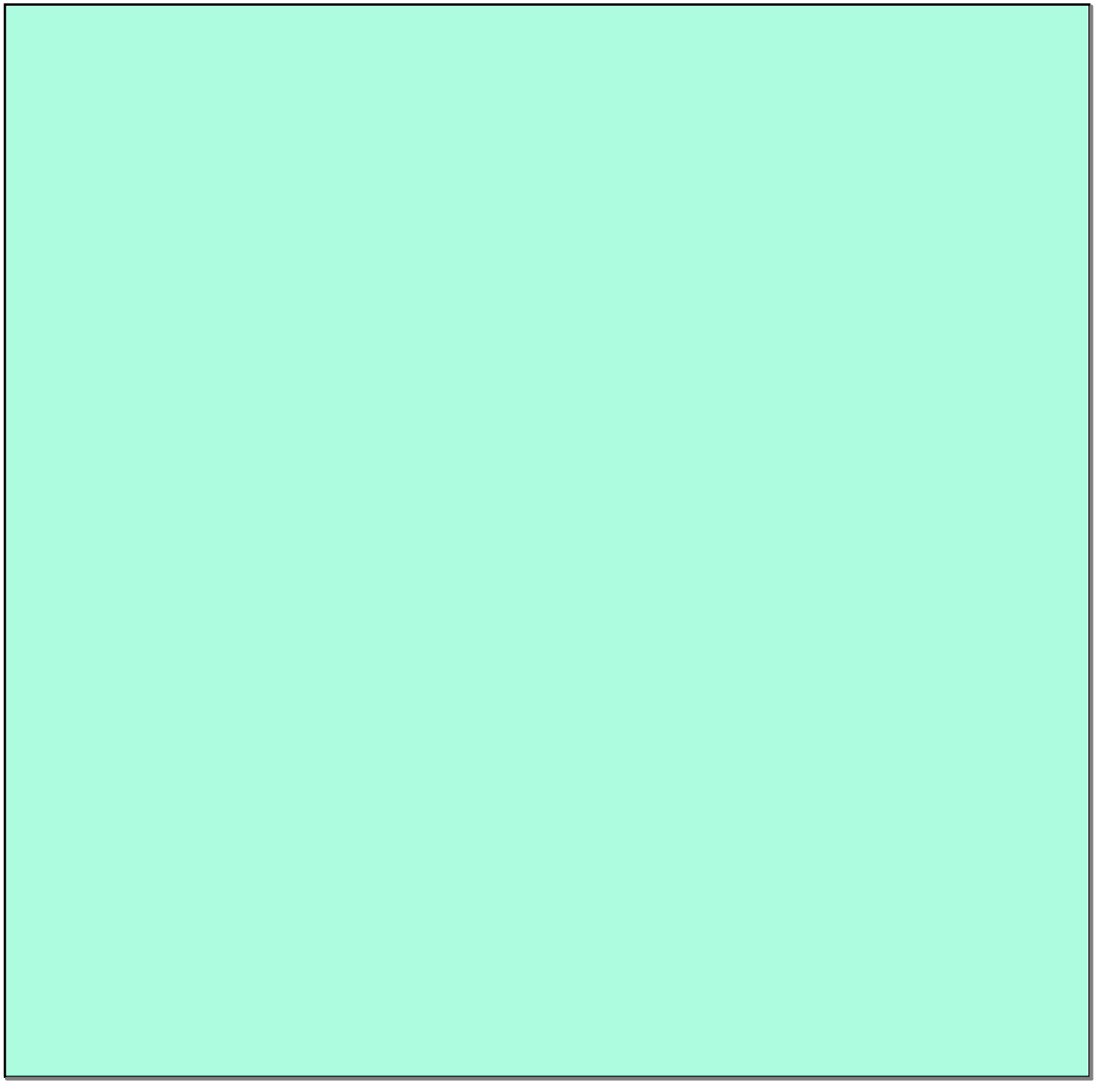

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