MATH 200
Calculus I

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Test 2

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Name: _____

Score: _____

Directions. Solve the following questions in the space provided. Unless noted otherwise, you must show your work to receive full credit. This is a closed-book, closed-notes test. Calculators, computers, etc., are not used. Put a your final answer in a $\boxed{\text{box,}}$ where appropriate.

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7. (10 points) Sketch the graph of both $y = \ln(x)$ **and** $y = e^x$ below. Be sure to indicate which graph is which.
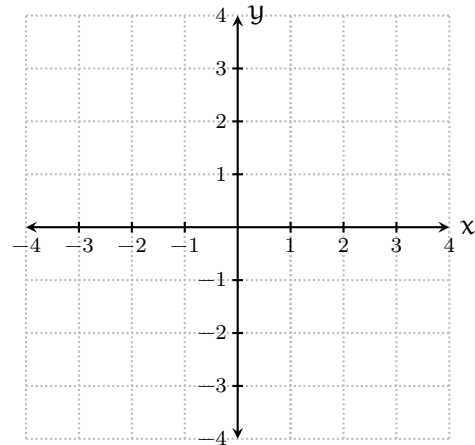
8. (5 points) $\sin(\tan^{-1}(x)) =$

1. (20 points) Warmup: short answer.

(a) $\dfrac{d}{dx}\left[\,\sin(x) + \cos(x)\,\right] =$

(b) $\dfrac{d}{dx}\left[\,\sin(x)\cos(x)\,\right] =$

(c) $\dfrac{d}{dx}\left[\,\sin\big(\cos(x)\big)\,\right] =$

(d) $\dfrac{d}{dx}\left[\,e^x\,\right] =$

(e) $\dfrac{d}{dx}\left[\,x^e\,\right] =$

(f) $\ln(1/e) =$

(g) $\sin^{-1}(1/2) =$

(h) $e^{\cos(\pi/2)} =$

(i) $\displaystyle\lim_{x \to -\infty} e^x =$

(j) $\displaystyle\lim_{x \to \infty} \tan^{-1}(x) =$

2. (10 points) Answer the following questions concerning the function $f(x)$ graphed below.
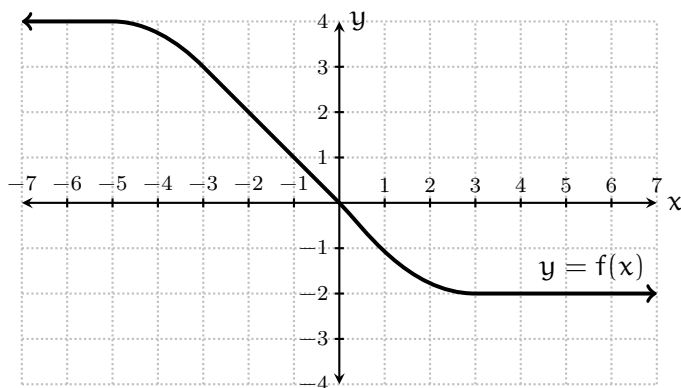
(a) Using the coordinate axis above, sketch the graph of the derivative $y = f'(x)$.

(b) Suppose $g(x) = (f(x))^3$. Find $g'(-2)$.

3. (15 points) An object moving on a straight line is $s(t) = 2 + t + t^3$ feet from its starting point at time t seconds.

(a) What is the object's velocity at time t?

(b) What is its acceleration at time t?

(c) Find its velocity when its acceleration is 12 feet per second per second.

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4. (10 points) This problem concerns the functions $f(x) = x^3 - 3x$ and $g(x) = 3x^2 + 6x$.
Find all x for which the tangent to $y = f(x)$ at $(x, f(x))$ is parallel to the tangent to $y = g(x)$ at $(x, g(x))$.

5. (20 points) Find the following derivatives.

(a) $\dfrac{d}{dx}\left[\ \ln(x) + \dfrac{1}{x} + \sqrt{x} + 3\ \right] =$

(b) $\dfrac{d}{dx}\left[\ \left(\dfrac{x^2+5}{x+1}\right)^4\ \right] =$

(c) $\dfrac{d}{dx}\left[\ \tan^{-1}(5x)\ \right] =$

(d) $\dfrac{d}{dx}\left[\ x\sec(e^{10x})\ \right] =$

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6. (10 points) This question concerns the equation $x^2 + xy + y^2 = 7$.

(a) Use implicit differentiation to find $\dfrac{dy}{dx}$.

(b) Use your answer from part (a) to find the **equation of the tangent line** to the graph of $x^2 + xy + y^2 = 7$ at the point $(2, -3)$.