Calculus 1 — Exam 2
MAT 250, Fall 2019 — D. Ivanšić

Name: _____

Show all your work!

Differentiate and simplify where appropriate:

1. (6pts) $\dfrac{d}{dx}\left(3x^7 - b^3 + \sqrt[5]{x^8} - \dfrac{7}{x^6}\right) =$

2. (6pts) $\dfrac{d}{dx}\left(x\sqrt{x+3}\right) =$

3. (6pts) $\dfrac{d}{dt}\dfrac{t^2-1}{2t+5} =$

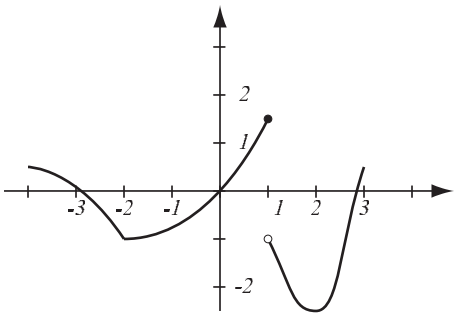
4. (7pts) $\dfrac{d}{d\theta}\dfrac{\sin\theta}{\cos^3\theta} =$

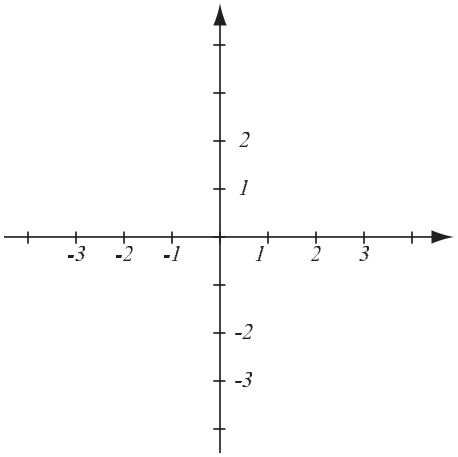
5. (6pts) $\dfrac{d}{dx}\sqrt[3]{\cos(x^2-7)} =$

6. (6pts) The position function of an object is given by $s(t) = t^2 - \sin(2t)$. Write the velocity and acceleration functions for this motion.

7. (10pts) The graph of the function $f(x)$ is shown at right.

a) Where is $f(x)$ not differentiable? Why?
b) Use the graph of $f(x)$ to draw an accurate graph of $f'(x)$.





8. (13pts) Let $f(x) = \sqrt{x}$, and $x > 0$.
a) Use the limit definition of the derivative to find the derivative of the function.
b) Check your answer by taking the derivative of f using differentiation rules.
c) Write the equation of the tangent line to the curve $y = f(x)$ at point $(9, 3)$.

9. (10pts) Let $g(x) = \dfrac{f(x)}{x^2}$ and $h(x) = f(x \cdot f(x))$.
a) Find the general expressions for $g'(x)$ and $h'(x)$.
b) Use the table of values at right to find $g'(3)$ and $h'(2)$.

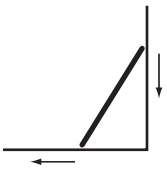
x	1	2	3	4
$f(x)$	-1	2	3	-5
$f'(x)$	-2	3	4	-1

10. (8pts) Find the point (x-coordinates only) on the curve $y = 2x^3 - 3x^2 - 31x + 7$ where the tangent line is parallel to the line $y = 5x - 17$.

11. (10pts) Use implicit differentiation to find y'.

$\sqrt{xy} = x^3 + y^3 - \tan y$

12. (12pts) A 9-foot ladder is sliding down the wall against which it is leaning. When the bottom of the ladder is 4 feet from the base of the wall, it is moving away from the wall at speed $\frac{1}{3}$ feet per second. How fast is the top of the ladder dropping at that moment?



Bonus. (10pts) Find points on the circle $x^2 + y^2 = 20$ where the tangent line is parallel to the line $6x - 2y = 4$. Draw the circle, the given line and the parallel tangent line(s). *(Hint: implicit differentiation is a little easier.)*