

EXAM 3 - MATH 112

Thursday, March 28

YOUR NAME: _____

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Consider the function $f(x) = x^5 - 20x^2$.

(a) Compute its first derivative and find the critical points.

(b) Compute the second derivative and find the critical points.

(c) Create the combined sign table for the first and second derivative and draw conclusions about f in the last line. Please do not omit any information from the table.

2. The sales amount of a certain commodity in billions of dollars is $S(x) = 7 - 12\sqrt{x}$, where x is the tax rate in decimal. Find the tax rate that maximizes the government revenue from the sales of this commodity. (Give both the exact answer and an approximation using 2 decimal digits.)

3. An open-top rectangular box with a square base is to have surface area 147 square inches. Find the dimensions of such a box that has maximum volume.

4. Find an equation for the tangent line to the graph of

$$x^2 + 3xy^2 - y^3 = 9$$

at the point $(x, y) = (2, 1)$.

5. An accident involving the sinking of a vessel has resulted in an oil spill. The area of pollution is circular. Environmental disaster response personnel are able to reduce the area of the oil slick by $\frac{\pi}{5}$ square miles per day. Find how fast the radius of the slick is changing when the radius is equal to $\frac{1}{2}$ mile. It is necessary that your answer is accompanied by a unit.

(Formulas for perimeter and area of a disk of radius r are $P = 2\pi r$ and $A = \pi r^2$.)