MIDTERM 2 REVIEW SESSION WORKSHEET FOR SPRING 2025

---

1. (20 points) You live on level ground. Your nosy neighbor has a drone with a camera, which is flying horizontally directly towards you, at 40 feet above you. You have a shotgun which you keep aimed at the drone. (You will shoot it down as soon as it crosses your property line.) When the drone is 70 feet away horizontally, it is approaching you at a horizontal speed of 20 feet per minute. How is the angle of elevation of your shotgun changing? (Be sure to include correct units.)

---

2. (16 points) If $y^2 = \arctan(3x - 5y) + \ln(11)$, find $\dfrac{dy}{dx}$ by implicit differentiation. (You must solve for $\dfrac{dy}{dx}$.)

---

3. (25 points) A jewelry container is supposed to have a top and bottom which are triangles **similar to** the right triangle with side lengths 3, 4, and 5 cm. (The side lengths need not be 3, 4, and 5 cm: these only give the proportions.) The sides of the container are vertical rectangles. If its volume is supposed to be 96 cubic centimeters, what should the height be to minimize the total surface area?

---

4. (17 points) Let $g(x) = x^3 - 12x + 2$. Identify the open intervals on which g is increasing, those on which g is decreasing, and all critical points, local minimums, and local maximums.

---

5. (11 points) Find the exact value of the limit $\lim\limits_{x \to -\infty} \left(\dfrac{2}{x^2} + 12 + 5x^3 \right)$ (possibly ∞ or $-\infty$), or explain why it does not exist, not even as $\pm\infty$. Give reasons.

---

6. (11 points) Find the exact value of the limit $\lim\limits_{x \to 2} \dfrac{e^{-x}}{x - 2}$ (possibly ∞ or $-\infty$), or explain why it does not exist, not even as $\pm\infty$. Give reasons.