# Final

Math 251 EOU Fall Name: _____

Show all work.

1. Find all inflection points of $f(x) = 3x^4 + x^3 - 2x + 1$. Round all $y$-coordinates to three decimal places. Include a sign diagram for $f''$ so that it's clear these are true inflection points and not just points where $f''(x) = 0$. (6 pts)

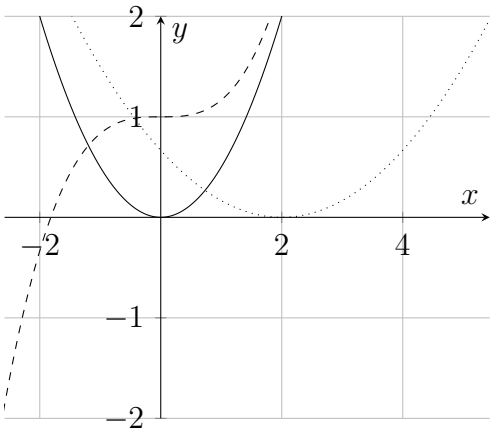
2. The position function of a particle is $s(t) = 5t\cos(t^2)$ where $t$ is in seconds and $s$ is in meters. What is the velocity of the particle when $t = 1$? Round your answer to two decimal places, and include correct units. (5 pts)

3. A box with a square base and an open top is made by cutting a square out of each corner of a piece of sheet metal which is 4 cm on a side. Find the largest volume that such a box can have. Round the volume to two decimal places. (6 pts)

4. Find all critical numbers of $f(x) = \dfrac{x}{2x^2 + 1}$. (6 pts)

5. The area of a circle is increasing at 5 $\text{cm}^2/\text{s}$. At what rate is the length of its radius increasing when the area is 100 $\text{cm}^2$? (5 pts)

6. Three functions are graphed below ($f$ is solid, $g$ is dashed, $h$ is dotted). One is an antiderivative of another. Fill in the blanks: "_____ is an antiderivative of _____". (3 pts)



7. Calculate $\int_1^4 (3x^2 + 10x + 2)\, dx$ exactly using the Evaluation Theorem. (6 pts)

8. Estimate $\sqrt[3]{7}$ by applying Newton's Method to the polynomial $f(x) = x^3 - 7$. Use an initial guess of $x_0 = 1$ and perform three iterations (so your answer will be $x_3$). Round your final answer to three decimal places. (6 pts)

9. Estimate the area under the graph of $f(x) = x^2 + 1$ between $a = 2$ and $a = 4$. Use $n = 4$ and left endpoints for your $x_i^*$ sample points. Round your estimate to two decimal places. (6 pts)

10. Find the absolute minimum of the function $f(x) = 3x^4 - 5x^3 - 9$ on $[-2, 3]$. Round your answer to two decimal places. (6 pts)

11. If $f''(x) = 6x^2 + 4x - 1$, $f(0) = 5$, and $f'(0) = -3$, find $f(x)$. (5 pts)

12. The speed of a particle between $t = 0$ and $t = 3$ seconds is given in the following table. The speed is given at half-second intervals in the table. Find a *lower* estimate for the change in position of the particle between $t = 0$ and $t = 3$ seconds (the speed is increasing on the interval $[0, 3]$). Round your estimate to two decimal places. (6 pts)

| $t$ (seconds) | 0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
|---|---|---|---|---|---|---|---|
| $v(t)$ (meters per second) | 0 | 0.25 | 0.70 | 1.15 | 1.30 | 1.50 | 1.75 |