

MATH 140
SPRING 2024
EXAM 3

NAME:

1. 10 pts. Find the absolute maximum and minimum values of $f(x) = 2x^6 - 15x^4 + 24x^2$ on $[-2, 2]$, and state where those values occur.
2. 7 pts. each Let $f(x) = \frac{x^2 + 12}{2x + 1}$.

 - (a) Find the domain and intercepts of f .
 - (b) Find the asymptotes of f .
 - (c) Find the critical points of f .
 - (d) Find the intervals of increase and decrease, as well as all local extrema.
 - (e) Find the intervals where f is concave up or down, and identify any inflection points.
3. 10 pts. Find the dimensions of the rectangle with maximum area that can be inscribed in a circle of radius 10.
4. 15 pts. A cylindrical can, open at the top, is to hold 500 cm^3 of liquid. Find the height and radius that minimize the amount of material needed to manufacture the can.
5. 10 pts. Find the linear approximation to the function $f(x) = \cos x$ at $\pi/4$, then use it to estimate the value of $\cos 0.82$. Round to six decimal places.
6. 10 pts. Show that the equation $6x^5 + 13x + 1 = 0$ has exactly one real root.
7. 10 pts. each Use L'Hôpital's Rule to evaluate each limit.

 - (a) $\lim_{x \rightarrow 0} \frac{1 - \cos 3x}{x^2}$
 - (b) $\lim_{x \rightarrow 0^+} (\sin x) \sqrt{\frac{1-x}{x}}$
8. 10 pts. each Determine the following indefinite integrals.

 - (a) $\int (\sqrt[4]{x^3} + \sqrt{x^5}) dx.$
 - (b) $\int \frac{3 - \tan \theta}{2 \sec \theta} d\theta.$