MTH 151
Exam 4
Spring 2025

Calculators are allowed. You may use a scientific calculator or a graphing calculator (e.g., TI-84) but not one with CAS (e.g., no TI-89, no TI-Nspire CAS). You may not use a phone app.

Show all work. Be neat and organized. Clearly indicate your answers.

100 points possible. 8 problems at 12 points each, plus 4 free points.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

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1. Use Newton's method on a graphing calculator to find the root of the given equation to at least 9 decimal places.

Use the given initial approximation x_1, and write down x_2, x_3, x_4, and so on, until the algorithm stabilizes. Show 9 decimal places for each step.

$$x^3 - 3x - 3 = 0, \qquad x_1 = 2$$

$x_1 = 2$

$x_2 =$

$x_3 =$

$x_4 =$

$x_5 =$

2. A farmer wants to fence an area of 117,600 square meters in a rectangular field and then divide it in half with an internal fence parallel to one of the sides of the rectangle. What dimensions of the field will minimize the total length of fencing? Use calculus methods. Include work that justifies why your answer gives an absolute minimum.

3. Find the indefinite integral.

$$\int \frac{9 - 10x^2}{\sqrt{x}}\, dx$$

In other words, find the most general antiderivative of $f(x) = \dfrac{9 - 10x^2}{\sqrt{x}}$

4. Find $f(x)$, given the following.

$$f''(x) = 12x^2 + 12x + 12, \qquad f(0) = 4, \quad f(1) = 20$$

5. When we estimate distances from velocity data, it is sometimes necessary to use times that are not equally spaced. We can still estimate distances using the time periods $\Delta t_i = t_i - t_{i-1}$. For example, a space shuttle was launched on a mission in order to install a new perigee kick motor in a communications satellite. The table provided gives the velocity data for the shuttle between liftoff and the jettisoning of the solid rocket boosters.

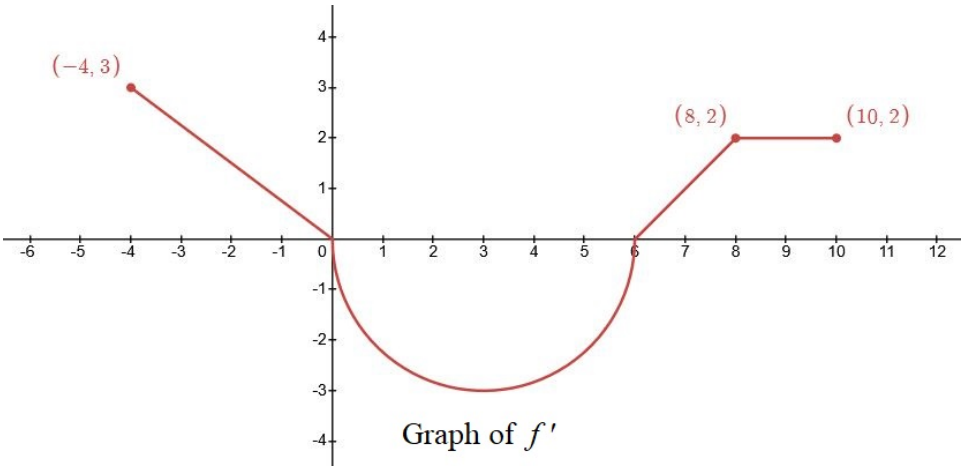
Event	**Time** (s)	**Velocity** (ft/s)
Launch	0	0
Begin roll maneuver	10	121
End roll maneuver	15	263
Throttle to 89%	20	386
Throttle to 67%	32	698
Throttle to 104%	59	1275
Maximum dynamic pressure	62	1385
Solid rocket booster separation	125	4091

Use a right Riemann sum with 4 intervals indicated in the table to estimate the height h (in ft), above the earth's surface of the space shuttle, 32 seconds after liftoff. (Give the upper approximation available from the data.)

6. Use part one of the fundamental theorem of calculus to find the derivative of the function.

$$g(x) = \int_0^x \sec^3 t \, dt$$

7. The function f is differentiable on the closed interval $[-4, 10]$ and satisfies $f(6) = 15$. The graph of f', the derivative of f, consists of a semicircle and three line segments, as shown in the figure.



(a) Find the value of $f(10)$.

(b) Find the value of $f(-4)$.

8. Find the indefinite integral.

$$\int x\sqrt{25-4x^2}\,dx$$