

1. 10 pts. each Find the limit or show that it does not exist.

(a) $\lim_{x \rightarrow -\infty} \frac{4x^3 + 6x^2 - 12}{5 - 4x - 3x^3}$

(b) $\lim_{x \rightarrow \infty} \left(\sqrt{x^2 + ax} - \sqrt{x^2 + bx} \right)$

2. Let $f(x) = \frac{x - x^2}{2 - 3x + x^2}$.

(a) 5 pts. Find the domain and intercepts of f .

(b) 5 pts. Find the asymptotes of f .

(c) 5 pts. Find the critical points of f .

(d) 10 pts. Find intervals of increase and decrease, and find all local extrema.

(e) 10 pts. Find intervals of concavity, and identify any inflection points.

3. 10 pts. Find the point on the curve $y = \sqrt{x}$ that is closest to the point $(3, 0)$.

4. 15 pts. A fence 8 ft tall runs parallel to a tall building at a distance of 4 ft from the building. What is the length of the shortest ladder that will reach from the ground over the fence to the wall of the building?

5. 10 pts. Find the most general antiderivative of

$$f(x) = \sqrt[3]{x^2} + x\sqrt{x}.$$

6. 10 pts. Find f , given that $f''(\theta) = \sin \theta + \cos \theta$, $f(0) = 3$, and $f'(0) = 4$.

7. 15 pts. Use the definition of the definite integral to evaluate

$$\int_{-2}^0 (x^2 + x) dx.$$

8. 10 pts. Evaluate the integral by interpreting it in terms of areas:

$$\int_{-3}^0 \left(1 + \sqrt{9 - x^2} \right) dx.$$

9. 10 pts. Use the Fundamental Theorem of Calculus to find the derivative of

$$y = \int_{\sqrt{x}}^{\pi/4} \theta \tan \theta \, d\theta.$$

10. 10 pts. each Use the Fundamental Theorem of Calculus to evaluate the integral.

(a) $\int_0^1 (1 - 8v^3 + 16v^7) \, dv$

(b) $\int_{\pi/6}^{\pi/2} \csc t \cot t \, dt$