

Math 181 Study Guide for Exam #3

- (4.1) 1. Find the critical number(s), if any, of the function $f(x) = x^3 - 6x - 4$.
A. $\pm\sqrt{2}$
- (4.1) 2. Find the critical number(s), if any, of the function $h(u) = \frac{7u}{u^2 + 36}$. A. +/- 6
- (4.1) 3. Find the absolute maximum and absolute minimum values, if any, of the function $f(x) = 5 + 9 \sin 2x$ on $\left[0, \frac{\pi}{2}\right]$.
A. abs. max. $f\left(\frac{\pi}{4}\right) = 14$
abs. min. $f(0) = f\left(\frac{\pi}{2}\right) = 5$
- (4.2) 4. Find the number c that satisfies the conclusion of the Mean Value Theorem on the given interval.
 $f(x) = 2\sqrt{x}$, $[0, 25]$ A. $c = 25/4$
- (4.2) 5. The function $f(x) = x^2 + 10x + 27$ satisfies the hypotheses of Rolle's Theorem on the interval $[-10, 0]$. Find all values of c that satisfy the conclusion of the theorem. A. -5
- (4.3) 6. Determine where the graph of the function $f(x) = 3 + 4x^{1/3}$ is concave upward and where it is concave downward. Also, find all inflection points of the function.
A. CU on $(-\infty, 0)$, CD on $(0, \infty)$,
IP $(0, 3)$
- (4.3) 7. Use the Second Derivative Test to find the relative extrema, if any, of the function $f(x) = 2x^3 - 3x^2 - 36x - 5$.
A. Rel. max. $f(-2) = 39$,
rel. min. $f(3) = -86$

- (4.3) 8. Find the relative (local) extrema, if any, of $f(t) = e^t - 7t - 3$. Use the Second Derivative Test, if possible.

A. relative minimum: $f(\ln 7) = 4 - 7\ln 7$,
relative maximum: none

- (4.3) 9. How many points of inflection are on the graph of the function?

$$f(x) = 18x^3 + 5x^2 - 12x - 20$$

A. 1

- (4.3) 10. Given $f(x) = x + \frac{1}{x}$. (a) Find the intervals on which f is increasing or decreasing, (b) Find the relative (local) maxima and relative (local) minima of f .

A. (a) Increasing on $(-\infty, -1)$ and $(1, \infty)$, decreasing on $(-1, 0)$ and $(0, 1)$
(b) Rel. max. $f(-1) = -2$,
rel. min. $f(1) = 2$

- (4.4) 11. Find the $\lim_{t \rightarrow 0} \frac{4^t - 3^t}{t}$

A. $\ln 4 - \ln 3$

- (4.4) 12. Find the $\lim_{u \rightarrow 2^+} \frac{-5u^2}{u - 2}$

A. $-\infty$

- (4.4) 13. Find the $\lim_{x \rightarrow (\pi/2)^-} \frac{-3}{5 \cos(x)}$

A. $-\infty$

- (4.4) 14. Find the $\lim_{x \rightarrow -\infty} \frac{x^2 - 2}{5x^2 + 9}$

A. $1/5$

(4.4) 15. Evaluate the limit using l'Hôpital's Rule. $\lim_{x \rightarrow 5} \frac{x^3 - 125}{x - 5}$ A. 75

(4.4) 16. Evaluate the limit using l'Hôpital's Rule. $\lim_{x \rightarrow 0} \frac{(7 \sin x)^2}{1 - \sec x}$ A. -98

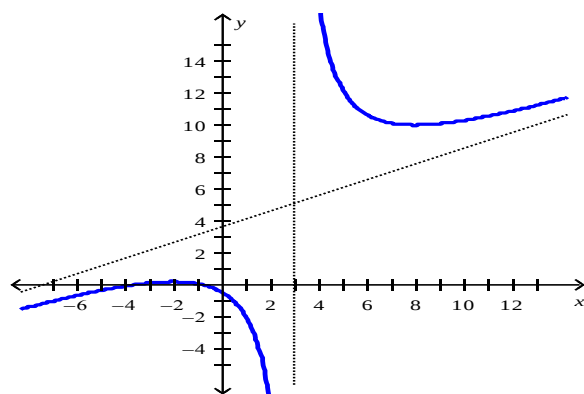
(4.4) 17. Evaluate the $\lim_{x \rightarrow \infty} \left(x - \sqrt{x^2 + 2} \right)$ A. 0

(4.4) 18. Evaluate the limit $\lim_{x \rightarrow 0} \frac{e^{6x} - e^{-8x}}{\ln(1+x)}$ using l'Hôpital's Rule. A. 14

(4.4) 19. Find the limit. $\lim_{x \rightarrow \infty} \frac{x^5 - 4}{x^4 + 5}$ A. ∞

(4.4) 20. Evaluate the limit. $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^5 + x^4}$ A. ∞

(4.5) 21. Find the slant asymptote of the graph of $f(x) = \frac{x^2 + 4x + 3}{2x - 6}$ using the curve-sketching guidelines.



(4.7) 22. Find two positive numbers whose product is 121 and whose sum is a minimum.

A. 11, 11

(4.7) 23. Find the dimensions of the rectangle of largest area that can be inscribed in an equilateral triangle of side $L = 9$ cm if one side of the rectangle lies on the base of the triangle.
Round your answer to the nearest tenth.

A. 4.5 cm, 3.9 cm

(4.7) 24. Find the point on the line $y = 4x + 8$ that is closest to the origin. A. $(-32/17, 8/17)$

(4.7) 25. Find the dimensions of a rectangle of area 64 ft^2 that has the smallest possible perimeter.

A. 8 ft by 8 ft

(4.9) 26. Find f . $f'''(x) = 18x + 24x^2$

A. $f(x) = 3x^3 + 2x^4 + Cx + D$

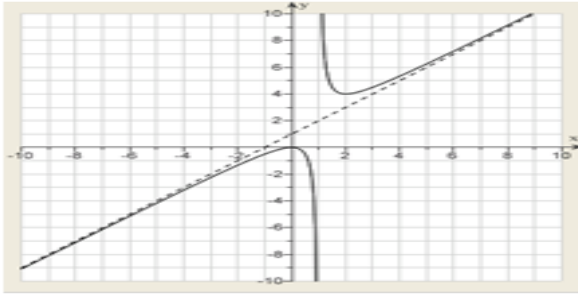
(4.9) 27. Find f . $f'(t) = 2t - 4 \sin t$, $f(0) = 5$

A. $f(t) = t^2 + 4 \cos t + 1$

(4.9) 28. Find the most general antiderivative of the function. $f(x) = 15x^2 - 16x + 9$

A. $F(x) = 5x^3 - 8x^2 + 9x + C$

- (4.5) 29. Sketch the curve. Find the equation of the slant asymptote. $y = \frac{x^2}{x-1}$



← A.

- (4.9) 30. The sum of two positive numbers is 16. What is the smallest possible value of the sum of their squares?

A. 128

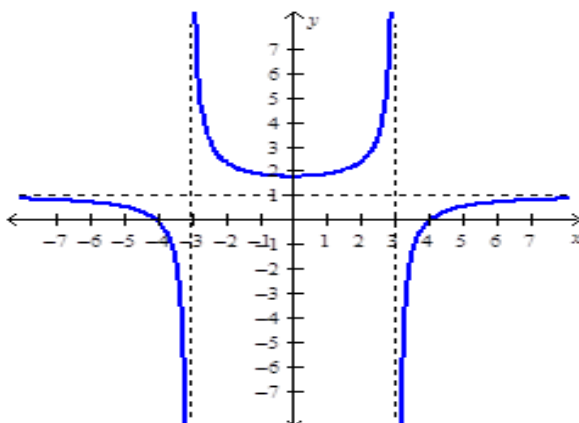
- (4.9) 31. Find the most general antiderivative of the function. $f(x) = 5 \cos x - 7 \sin x$

A. $5 \sin(x) + 7 \cos(x) + C$

- (4.9) 32. Find the most general antiderivative of the function. $f(x) = 8x^{1/7} - 11x^{1/10}$

A. $7x^{8/7} - 10x^{11/10} + C$

- (4.5) 33. Sketch the graph of the function $f(x) = \frac{x^2 - 16}{x^2 - 9}$ using the curve-sketching guidelines.



← A.

(4.7) 34. Find two numbers whose difference is 170 and whose product is a minimum.

A. -85 , 85

(4.9) 35. Find the position function of a particle moving along a coordinate line that satisfies the given condition.

$$v(t) = 3t^2 - 4t + 4, \quad s(1) = -1$$

A. $t^3 - 2t^2 + 4t - 4$

