

Spring 2012 Math 151

Sample Problems for Exam 1

sections: Chapter 1, 2,2, 2,3, 2.5, 2.6, 2.7, and 3.1

courtesy: Joe Kahlig

This collection of questions is intended to give an idea of different types of question that might be asked on the exam. This is not intended to represent an actual exam.

1. Use the definition of the derivative to find the derivatives of these functions.

(a) $f(x) = \frac{2x}{x+3}$

(b) $f(x) = \sqrt{2x+1}$

2. Compute $f'(2)$ if $f(x)$ is a function such that: $f(x+h) - f(x) = 3x^2h + 4xh^2 - 2xh + h^3 + 7h$.

3. Find the equation of the tangent line for $f(x) = \sqrt{2x+1}$ at $x = 4$.

4. Let $f(x)$ be a function whose graph passes through the point $(3, 5)$. The derivative of $f(x)$ is given by

$f'(x) = \sqrt{8x+1}$. Compute $\lim_{x \rightarrow 3} \frac{f(x) - 5}{x - 3}$.

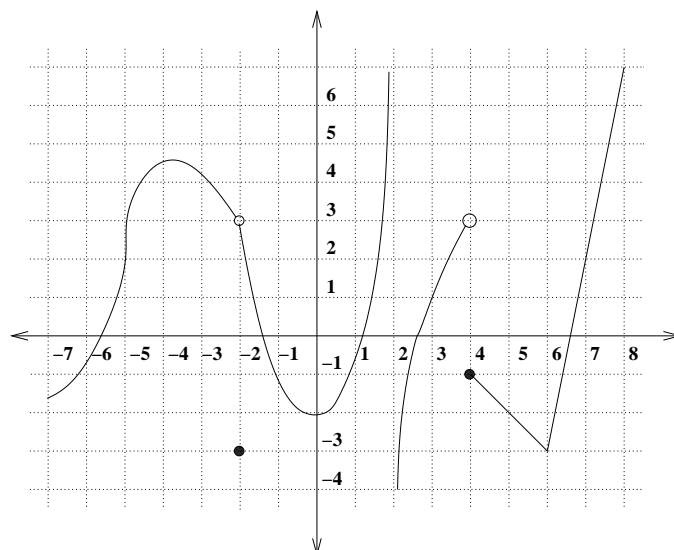
5. Use the graph of $f(x)$ to answer these questions.

(a) $\lim_{x \rightarrow -2} f(x) =$

(b) $\lim_{x \rightarrow 4} f(x) =$

- (c) Determine the values of x where the function is not continuous. For each of these numbers state if f is continuous from the right, from the left, or neither.

- (d) Determine the values of x where the function is not differentiable.



6. Find a function that has a removable discontinuity at $x = 5$, a vertical asymptote of $x = -3$, and a horizontal asymptote of $y = 7$.

Compute these limits.

7. $\lim_{x \rightarrow -5} \frac{x^3 + 4x^2 - 5x}{x^5 - 25x^3} =$

8. $\lim_{x \rightarrow 0} \frac{x^3 + 4x^2 - 5x}{x^5 - 25x^3} =$

9. $\lim_{x \rightarrow 5} \frac{x - 1}{x^2(x - 5)} =$

10. $\lim_{x \rightarrow 0} \left(\frac{1}{x} - \frac{7}{4x^2 + 7x} \right) =$

11. $\lim_{x \rightarrow -\infty} \frac{5x + \sqrt{9x^2 - 5x + 1}}{5x + 3} =$

12. $f(x) = \begin{cases} \frac{-3x^7 - 4x^3 + 7}{x^3 + 10} & \text{if } x < 0 \\ \frac{6x^4 + 18}{5x^4 + 2} & \text{if } x \geq 0 \end{cases}$

(a) $\lim_{x \rightarrow \infty} f(x)$

(b) $\lim_{x \rightarrow -\infty} f(x)$

13. Is this function continuous? If no, then find the values of x where this function will not be continuous. Fully justify your answers.

$$f(x) = \begin{cases} \frac{16x}{x^2 - 9} & \text{if } x < 1 \\ 5x - 6 & \text{if } x \geq 1 \end{cases}$$

14. What value(s) of A and B would make the function $f(x)$ continuous? If it is not possible to make $f(x)$ continuous then explain why.

$$f(x) = \begin{cases} Ax^2 + 5x - 1 & \text{if } x < 2 \\ B & \text{if } x = 2 \\ 5Ax - 6 & \text{if } x > 2 \end{cases}$$

15. Given $\mathbf{m} = 3\mathbf{i} - 4\mathbf{j}$ and $\mathbf{n} = \mathbf{i} - 3\mathbf{j}$ answer the following.

(a) Compute the scalar and vector projections of \mathbf{m} onto \mathbf{n} .

(b) What is the angle between \mathbf{m} and \mathbf{n} ?

16. Find a parametric equation for the line through the points $(2, 4)$ and $(7, 5)$.

17. Show that the line $L_1 = \langle -6t, 1 + 9t \rangle$ and $L_2 = \langle 13 - 3s, 1 - 2s \rangle$ are orthogonal.

18. A constant force $\mathbf{F} = 5\mathbf{i} + 6\mathbf{j}$, magnitude is in Newtons, moves an object along the straight line from the point $(-1, 2)$ to the point $(2, 3)$. Find the work done by \mathbf{F} if the distance is measured in meters.

19. A man walks due east on the deck of a ship at 2 mph. The ship is moving $S60^\circ E$ at a speed of 20 mph. Find the direction and speed of the man relative to the surface of the water.

20. Answer the following with the parametric curve: $x(t) = 1 + \cos(t)$, $y(t) = 1 - \sin^2(t)$.

(a) Find a Cartesian equation for this curve.

(b) Does the parametric curve go thru the point $(1, 0)$? If yes, give the value(s) of t .

(c) Sketch the graph of the parametric curve on the interval $0 \leq t \leq \pi$. include the direction of the path.

21. If $\cos(\theta) = \frac{7}{10}$ and θ is in Quadrant IV, find the exact value of $\sin(2\theta)$.

22. The points $A(1, 5)$, $B(5, 0)$, and $C(7, 10)$ for a triangle. Find angle B.