MATH 151
FALL 2009

SAMPLE EXAM I

TYPICAL INSTRUCTIONS ON A MATH 151 COMMON EXAM:

1. In Part I (Problems 1-16) Mark the correct choice on your scantron. Use the back of each page for scratch work. The scantron will be collected after 90 minutes; calculators will not be allowed during this exam.

2. In Part II (Problems 17-25), write all solutions in the space provided. Calculators are not allowed. Use the back of each page for scratch work. CLEARLY INDICATE YOUR FINAL ANSWER.

NOTE: The spacing was greatly reduced on this document to limit the number of pages you need to print. You will have more room on the common exam to work.

Part I - Multiple Choice

For problems 1 through 16, circle the correct answer on your exam. Each question is worth ? points.

1. What is the slope of the line with parametric equations $x = 2t + 3$, $y = 7t - 2$?

a) $\frac{7}{2}$

b) $\frac{-2}{7}$

c) $\frac{3}{2}$

d) $\frac{-2}{3}$

e) $\frac{2}{7}$

2. What value of x makes the vectors $\langle 1, x \rangle$ and $\langle 3 - 4x, 5 \rangle$ perpendicular?

a) $x = -3$

b) $x = -1$

c) $x = 0$

d) $x = 1$

e) $x = 3$

3. Which of the following gives parametric equations of the line passing through $(-1, 1)$ and perpendicular to the line $x = 4 - 3t$, $y = 5 + t$?

a) $\mathbf{r}(t) =< -2 - t, -2 + t >$

b) $\mathbf{r}(t) =< -1 - t, 1 - 3t >$

c) $\mathbf{r}(t) =< -1 + t, 1 + 3t >$

d) $\mathbf{r}(t) =< -2 - 3t, -2 - t >$

e) both (b) and (c) are correct

4. $\lim_{x \to 4} \frac{2x^2 - 32}{x - 4} =$

a) 1 b) 0 c) 2 d) does not exist e) 16

5. If $f(x) = \dfrac{4x^2 + 3x - 3}{x}$, then $f'(x) =$

a) $8x + 3$ b) $\dfrac{8x + 3}{x^2}$

c) $4 + \dfrac{3}{x^2}$ d) $4x^2 + 3$

e) 4

6. According to the Intermediate Value Theorem, the equation $x^3 - 2x^2 + x = -5$ has a solution in which of the following intervals?

a) $[-3, -2]$ b) $[2, 3]$

c) $[-2, -1]$ d) $[-1, 0]$

e) $[0, 1]$

7. $\lim\limits_{x \to 1} \dfrac{x + 1}{(x - 1)^2} =$

a) 0 b) does not exist c) $-\infty$

d) ∞ e) 1

8. Given $f(x) = \begin{cases} 5 - \frac{2}{5}x & \text{if } x < 5 \\ 3 & \text{if } 5 < x < 8 \\ 9 - x & \text{if } x > 8 \end{cases}$, which of the following statements is TRUE?

a) f is continuous at $x = 5$

b) $\lim\limits_{x \to 5} f(x)$ does not exist.

c) $\lim\limits_{x \to 8^+} f(x) = 3$

d) $\lim\limits_{x \to 5} f(x) = 3$

e) f is continuous for all values of x.

9. If $f(x) = \dfrac{2xg(x)}{x^2+1}$ and $g(1) = 3$, $g'(1) = -4$, find $f'(1)$.

a) -2

b) 8

c) -4

d) -8

e) 16

10. Given the points $P(4, -4)$ and $Q(5, -2)$, find a unit vector in the direction of the vector starting at P and ending at Q.

a) $\dfrac{1}{\sqrt{5}}\mathbf{i} + \dfrac{2}{\sqrt{5}}\mathbf{j}$ b) $\dfrac{140}{\sqrt{29}}\mathbf{i} - \dfrac{56}{\sqrt{29}}\mathbf{j}$ c) $9\mathbf{i} - 6\mathbf{j}$

d) $\mathbf{i} + 2\mathbf{j}$ e) $\dfrac{9}{\sqrt{117}}\mathbf{i} - \dfrac{6}{\sqrt{117}}\mathbf{j}$

11. $\lim\limits_{x\to\infty} \dfrac{6x^2 - x - 3}{2 + 3x - 3x^2} =$

a) 3 b) 1 c) ∞ d) -2 e) $-\dfrac{3}{2}$

12. $\lim\limits_{x\to 5} \dfrac{\frac{1}{x} - \frac{1}{5}}{x - 5} =$

a) $-\dfrac{1}{25}$ b) 1 c) does not exist d) -1 e) $\dfrac{1}{25}$

13. Given the points $A(-1, 2)$, $B(2, 1)$, and $C(0, 5)$, find angle C.

a) $45°$ b) $30°$ c) $135°$ d) $150°$ e) $90°$

14. The parametric curve determined by the equations $x = \sin t$, $y = \cos^2 t$, $0 \leq t \leq \dfrac{\pi}{2}$ forms:

a) part of a parabola

b) part of a hyperbola

c) part of a circle

d) line segment

e) none of the above

15. Find all vertical asymptotes for the curve $\dfrac{x-2}{x^2-4}$

a) $x = 0$

b) $x = -2$ and $x = 2$

c) $x = -2$ only

d) $x = 2$ only

e) There are no vertical asymptotes.

16. If $f(x) = |x^2 - 8x|$, then $f'(6) =$

a) 4

b) -4

c) 0

d) ± 4

e) $f(x)$ is not differentiable at $x = 6$, hence $f'(6)$ does not exist.

Part II - Work Out Problems

Work the following problems in the space provided. Calculators are not allowed and all answers must be algebraically supported to receive full credit.

17. If two forces given by $\mathbf{F_1} = \langle 1, 5\rangle$ and $\mathbf{F_2} = \langle 4, 1\rangle$ are acting on an object sitting at the origin, find the resultant force as well as its magnitude and direction.

18. Compute:

a.) $\lim_{x\to\infty}(\sqrt{x^2+5x+1}-x)$

b.) $\lim_{x\to-\infty}(x+\sqrt{x^2+2x-4})$

19. Find the points on the graph of $y = x^2 + x$ where the tangent line also passes through the point $(2, 5)$.

20. Given the vector equation $\langle 3t, 5t - t^2\rangle$, find parametric equations for the tangent line to the curve corresponding to $t = 1$. What is the cartesian equation of this line?

21. Find the vector projection of $< -6, -5 >$ onto $< 1, -4 >$.

22. Use the limit definition to find the derivative of $f(x) = \sqrt{2-3x}$ at $x = -1$.

23. Find the equation of the line tangent to $f(x) = \dfrac{x+1}{x^2-3}$ at the point where $x = 2$.

24. Evaluate $\lim_{x\to 3}\dfrac{|x-3|}{x^2-9}$, if it exists. if the limit does not exist, support your answer by evaluating left and right hand limits.

25. (From spring 2005 common exam) For which values of a and b is $f(x)$ continuous for all x?

$$f(x) = \begin{cases} x^2 + ax + b & \text{if } x < 1 \\ 3 & \text{if } x = 1 \\ -ax^2 + 2bx + 6 & \text{if } x > 1 \end{cases}$$