

MA 223 Final Exam Practice Problems

READ CAREFULLY: This is a two-hour final exam. Anything, except worked out examples, that can fit on two sides of an 8 1/2 by 11 inch piece of paper may be used as a reference during this test and you are to hand in your sheet with your name on it when you complete your final exam. A graphing calculator may also be used. No other aids are permitted. Circle only one answer for each problem, unless the directions for a problem say to choose one or more. Then fill in the grids on your ScanTron form. In order to receive credit for a problem, you must show your work or give a reason(s) for your answer choice(s) – NO WORK or a REASON(S) for your answer choice(s), NO CREDIT! You may receive partial credit for your work or reasoning if you do not make the correct answer choice(s).

1. The domain of the function defined by $f(x) = \frac{x^2 + 2x}{x^2 - 2x + 1}$ is

- A. $\{x \mid x = 1\}$ B. $\{x \mid x = -2, x = 0, x = 1\}$ C. $\{x \mid x = -2, x = 0\}$
 D. $\{x \mid x \neq -1\}$ E. $\{x \mid x \neq 1\}$

2. Huskie dogsleds sell for \$200 a piece, cost \$110 a piece to produce and have a fixed monthly cost of \$12,700. How many skateboards must Huskie sell to break-even (that is, when the profit is zero)? (Choose the closest one.)

- A. 135 B. 138 C. 141 D. 144 E. 147

3. The function given by $f(x) = \frac{1}{x^2 - 2x + 3}$ is continuous.

- A. True B. False

4. For the piecewise function defined by $f(x) = \begin{cases} 3 - 5x^2 & \text{for } x \leq 1 \\ \frac{x^2 - 4}{x + 2} & \text{for } x > 1 \end{cases}$

evaluate $\lim_{x \rightarrow 1^+} f(x)$, if the limit exists.

- A. -2 B. -1 C. 1 D. 2 E. Does not exist.

5. For the piecewise function defined by $f(x) = \begin{cases} 3 - 5x^2 & \text{for } x \leq 1 \\ \frac{x^2 - 4}{x + 2} & \text{for } x > 1 \end{cases}$

evaluate $\lim_{x \rightarrow 1} f(x)$, if the limit exists.

- A. -2 B. -1 C. 1 D. 2 E. Does not exist.

6. For the piecewise function defined by $f(x) = \begin{cases} 3 - 5x^2 & \text{for } x < 1 \\ \frac{x^2 - 1}{x - 1} & \text{for } x > 1 \end{cases}$

evaluate $\lim_{x \rightarrow 1^+} f(x)$, if the limit exists.

- A. -2 B. -1 C. 1 D. 2 E. Does not exist.

7. If $y = f(x)g(x)$ for differentiable functions f and g , then $\frac{dy}{dx} = f'(x)g(x) + f(x)g'(x)$.

- A. True B. False

8. For the piecewise function defined by $f(x) = \begin{cases} 3 - 5x^2 & \text{for } x < 1 \\ \frac{x^2 - 1}{x - 1} & \text{for } x > 1 \end{cases}$

at $x = 1$, the function

- A. has a limit, is continuous and is differentiable.
 B. has a limit, is continuous, but is not differentiable.
 C. has a limit, but is not continuous and is not differentiable.
 D. does not have a limit, but is continuous and is differentiable.
 E. does not have a limit, is not continuous and is not differentiable.

9. A simplified difference quotient for $f(x) = \frac{3}{x - 2}$ is

- A. $\frac{-3h}{(x - 2)(x + h - 2)}$ B. $\frac{-3}{(x - 2)^2}$ C. $\frac{-3}{(x - 2)(x + h - 2)h^2}$
 D. $\frac{-3}{(x - 2)(x + h - 2)}$ E. $\frac{-3}{(x - 2)(x + h - 2)h}$

10. If an equation of a tangent line to the graph of a differentiable function f at the point $(0, -2)$ is given by $2x - 3y = 6$, then $f'(0) =$

- A. 2 B. $-\frac{3}{2}$ C. $\frac{2}{3}$ D. $-\frac{2}{3}$ E. None of the above.

11. The position of an object is given by $s(t) = 2t^3 - 3t^2$ ft where t is the time in sec after the object begins its motion. When the velocity of the object is zero for $t > 0$, the acceleration is

- A. -1 ft per sec² B. 1 ft per sec² C. 0 ft per sec²
 D. 6 ft per sec² E. -6 ft per sec²

12. An equation of a vertical asymptotes of $f(x) = \frac{x^2 + 4x - 5}{x^2 - 6x + 5}$ is (choose one or more)

- A. $x=1$ B. $x=2$ C. $x=3$ D. $x=4$ E. $x=5$

13. The function defined by $f(x) = \frac{1}{4}x^4 + x^3 + 2$ has relative extrema at $x =$

- A. -3 B. 0 C. 1 D. 3 E. There are no extrema.

14. The function defined by $f(x) = \frac{1}{20}x^5 - \frac{1}{12}x^4 + 2x$ had inflection points at $x =$

- A. -2 B. -1 C. 0 D. 1 E. 2

15. The function defined by $f(x) = 2 - \frac{1}{4}x^4 - x^3$ is decreasing and concave up on the interval (choose one or more)

- A. (-3,0) B. (-2,0) C. (0,) D. (-3,)
E. None of the above.

16. Total inventory costs for washing machines sold at an appliance retail store are given

by $C(x) = 2x + \frac{35}{x} + 2000$ dollars, where x is the lot size of a reorder of washing

machines. What lot size will minimize inventory costs?

- A. 1 B. 2 C. 3 D. 4
E. None of the above.

17. An appliance firm is marketing a new freezer. It determines that in order to sell x freezers, the price per freezer must be $p = 250 - 0.03x$ dollars per freezer and the total cost of producing x freezers must be $C(x) = 0.6x^2 + 5000$ dollars. How many freezers must the firm sell in order to maximize their total profit if the maximum number of freezers the firm can sell is 300?

- A. 130 freezers B. 133 freezers C. 136 freezers D. 139 freezers
E. None of the above.

18. The total revenue of a retail store for a certain product is given by $R(x) = 215x - 0.43x^2$ dollars where x is the number of units of the product sold. Use the differential $dR = R'(x) dx$ to estimate the actual change in revenue, ΔR , when the number of units is decreased from $x = 40$ to 38. Choose the closest one.

- A. ΔR \$363 B. ΔR \$361 C. ΔR -\$363 D. ΔR -\$361
E. None of the above.

19. For $y = \sqrt{2x^5 - \frac{3}{x^2}}$, $\frac{dy}{dx} =$

- A. $\frac{1}{2} 2x^5 - \frac{3}{x^2}^{-\frac{1}{2}}$ B. $-\frac{1}{2} 2x^5 - \frac{3}{x^2}^{-\frac{1}{2}} 10x^4 - \frac{6}{x^3}$ C. $\frac{1}{2} 10x^4 + \frac{6}{x^3}^{-\frac{1}{2}}$
 D. $\frac{1}{2} 2x^5 - \frac{3}{x^2}^{-\frac{1}{2}} 10x^4 - \frac{6}{x^3}$ E. $\frac{1}{2} 2x^5 - \frac{3}{x^2}^{-\frac{1}{2}} 10x^4 + \frac{6}{x^3}$

20. For $f(x) = e^{2x} \cos(3x)$, $f'(x) =$

- A. $-e^{2x} \sin(3x)$ B. $-6e^{2x} \sin(3x)$ C. $e^{2x} (\cos(3x) - \sin(3x))$
 D. $e^{2x} (2\cos(3x) + 3\sin(3x))$ E. $e^{2x} (2\cos(3x) - 3\sin(3x))$

21. For $f(x) = 3x^4 \ln(5x)$, $f'(x) =$

- A. $12x^3 \ln(5x) + \frac{3x^3}{5}$ B. $12x^3 \ln(5x) + 3x^3$ C. $12x^2$
 D. $12x \ln(5x) + 3x^3$ E. $12x \ln(5x) + \frac{3x^3}{5}$

22. If $\frac{dN}{dt} = -0.032N$ and $N_0 = 12$, then

- A. $N = 12e^{0.032t}$ B. $N = -0.032e^{12t}$ C. $N = -12e^{-0.032t}$
 D. $N = 12e^{-0.032t}$ E. None of the above.

23. An office machine is purchased for \$5200. Under certain assumptions, the salvage value of the machine after t years is given by $V(t) = 5200 \left(\frac{5}{4}\right)^{-t}$. Find the rate of change of the salvage value V respect to time.

- A. $5200 \left(\frac{5}{4}\right)^{-t-1}$ dollars per year B. $-5200 \left(\frac{5}{4}\right)^{-t-1}$ dollars per year
 C. $-5200 \left(\frac{5}{4}\right)^{-t}$ dollars per year D. $-5200 \ln \left(\frac{5}{4}\right) \left(\frac{5}{4}\right)^{-t}$ dollars per year
 E. $5200 \ln \left(\frac{5}{4}\right) \left(\frac{5}{4}\right)^{-t}$ dollars per year

24. A group of theatrical agents forms a new agency they call Top Stars and the agency initially had 5 clients from previous contracts of Top Stars' agents. Top Stars decides that they will not sign more than 100 clients and they had 20 clients after one year. How many clients will Top Stars have after 18 months if the number of Top Stars' clients x is governed by the bounded growth model: $x(t) = L + (x_0 - L)e^{-kt}$, $x(0) = x_0$? Choose the closest one.

- A. 23 B. 26 C. 30 D. 37 E. 49

25. Carbon-14, a radioactive isotope of carbon, has a half-life of 5720 years. If you have a sample of 2000 grams of carbon-14, how much remains after 40 years? Use the decay model

$$\frac{dC}{dt} = -kC \quad \text{and} \quad C(0) = C_0$$

Choose the closest one.

- A. 1986 grams B. 1989 grams C. 1990 grams D. 1993 grams E. 1999 grams

26. After 2 years, an initial animal population of 10 grows to 18. If the environment in which the animals live will only support 60 of the animals, how many animals will there be 4 years after the population grows to 18 animals? Use the logistic growth model: $P(t) = \frac{P_0 L}{P_0 + (L - P_0)e^{-Lkt}}$,

$P(0) = P_0$. Choose the closest one.

- A. 29 B. 34 C. 40 D. 47 E. 55

1. E 2. C 3. A 4. B 5. E 6. D 7. B 8. E 9. D 10. C 11. D 12. E 13. A 14. D 15. B
16. D 17. D 18. D 19. E 20. E 21. B 22. D 23. D 24. B 25. C 26. C