BARUCH COLLEGE
MATH 2207 Practice Final 2, Part 1, PART 1, NO CALCULATORS

1. Find the absolute *minimum* value of $f(x) = -x^3 + 12x + 1$ on the interval $0 \le x \le 3$. 1._____

(A) -15 (B) 1 (C) 10 (D) 17 (E) -2

2. Find the derivative of $y = \dfrac{2x^2}{x^2 - 5}$. 2._____

(A) $\dfrac{20x}{(x^2-5)^2}$ (B) $\dfrac{-20x}{(x^2-5)^2}$ (C) $\dfrac{4x^3}{(x^2-5)^2}$
(D) $\dfrac{-4x^3}{(x^2-5)^2}$ (E) $\dfrac{4x}{(x^2-5)^2}$

3. The cost of producing x items is $C(x) = 2x^3 - 20x^2 + 100x$. Find the value of x that minimizes the AVERAGE cost. 3._____

(A) 5 (B) 6 (C) 3 (D) 8 (E) 2

4. Find the horizontal asymptote of the graph of $f(x) = \dfrac{3x^3 - x^2 + 2x - 1}{3 - 5x + 3x^2 + 5x^3}$. 4._____

(A) $y = -\dfrac{1}{3}$ (B) $y = 1$ (C) $y = \dfrac{1}{3}$
(D) $y = 0$ (E) $y = \dfrac{3}{5}$

5. Use implicit differentiation to find $\dfrac{dy}{dx}$ at the point $(2, 1)$ for the equation $3x^2 - 2xy + y^2 = 9$. 5._____

(A) 5 (B) 3 (C) -5
(D) -1 (E) 1

6. If $f(x) = xe^{x^2+1}$, then $f'(2)$ is 6._____

(A) $9e^5$ (B) $6e^5$ (C) $2e^5$
(D) $8e^5$ (E) e^4

7. $\displaystyle\int_0^4 \frac{1}{3x+1}\,dx =$ 7._____

(A) $\frac{1}{13}$ (B) $\frac{1}{13}\ln 4$ (C) $\frac{1}{3}\ln 13$ (D) $\frac{1}{4}$ (E) $\frac{3}{3x+1}$

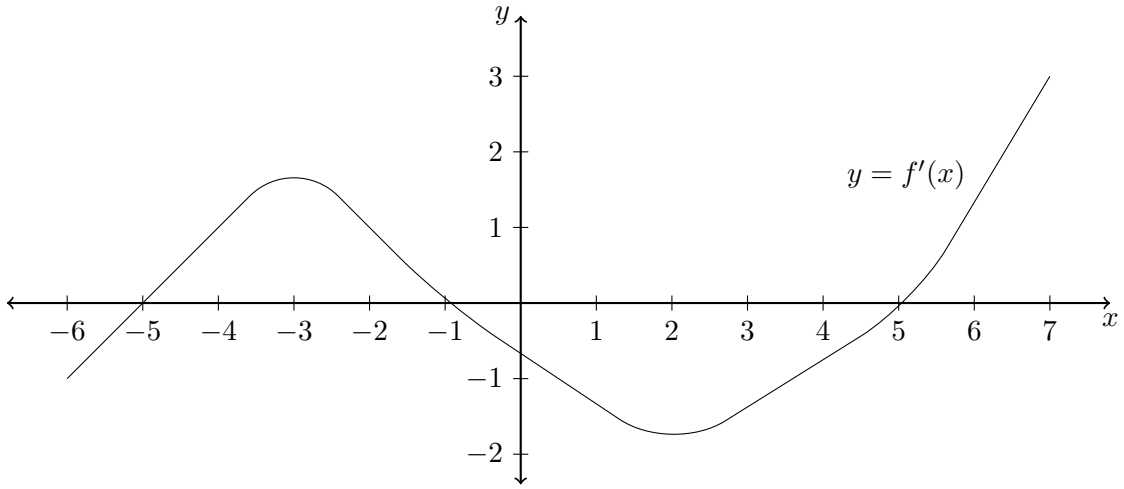
8. Find $\frac{dy}{dx}$ for $y = \ln\left(\frac{\sqrt{x-5}}{4x^3+1}\right)$. 8._____
Hint: Use the properties of the logarithm function before differentiating.

(A) $\frac{\sqrt{x-5}}{4x^3+1}$ (B) $\frac{1}{2(x-5)} - \frac{12x^2}{4x^3+1}$ (C) $\frac{4x^3+1}{\sqrt{x-5}}$
(D) $e^{\sqrt{x-5}} - e^{4x^3+1}$ (E) $\frac{1}{2\sqrt{x-5}} - \frac{12x^2}{4x^3+1}$

9. If the second derivative of $f(x)$ is $f''(x) = (3-x)(x^2-4)$, on what interval(s) is $f(x)$ concave **up**? 9._____

(A) $(-\infty,-2)$ and $(2,3)$ (B) $(-2,2)$ (C) $(-\infty,\infty)$
(D) $(2,\infty)$ (E) $(-2,2)$ and $(3,\infty)$

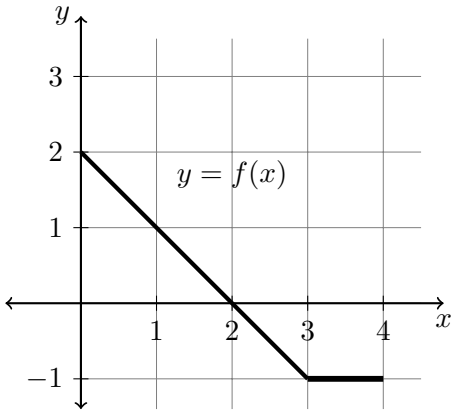
10. The graph of $f'(x)$, the *derivative* of f, is given below for $-6 \le x \le 7$. On what intervals is the <u>function</u>, $f(x)$, <u>increasing</u>? 10._____



Note: this is the graph of the <u>derivative</u> of $f(x)$, <u>not</u> the graph of $f(x)$ itself.

(A) $(-3,2)$ (B) $(-3,7)$ (C) $(-5,-1)$ and $(5,7)$
(D) $(-6,-3)$ and $(2,7)$ (E) $(-6,-5)$ and $(-1,5)$

11. The graph of $y = f(x)$ is given below. Evaluate $\int_0^4 f(x)dx$. 11._____



(A) 0.5 (B) 1.5 (C) -0.5
(D) 3.5 (E) -2.5

12. The position of an object at time t is given by $s(t) = t^3 + \frac{9}{2}t^2 - 12t + 27$, for $t \geq 0$. Find the time(s) when the velocity is zero. 12._____

(A) $t = 4$ (B) $t = 1$ (C) $t = 1$ and $t = 4$
(D) $t = 4/3$ (E) $t = 1/4$

13. Use differentials to find the approximate change in $f(x) = x^4$ as x changes from $x = 2$ to $x = 1.9$. 13._____

(A) -3.2 (B) $+0.0001$ (C) -0.004
(D) -0.008 (E) $+3.2$

14. The area of a square is increasing at a rate of 6 square inches per minute. At what rate is the length of one of its sides increasing when one of its sides has length equal to 2 inches? 14._____

(A) $\frac{3}{2}$ inches/minute (B) $\frac{3}{4}$ inches/minute (C) $\frac{2}{3}$ inches/minute
(D) $\frac{4}{3}$ inches/minute (E) $\frac{1}{3}$ inches/minute

15. The function $f(x) = 4x^3 + 9x^2 + 6x - 5$ has a point of inflection at 15._____

(A) $x = 1$ (B) $x = -\frac{1}{2}$ (C) $x = \frac{1}{4}$

(D) $x = -\frac{3}{4}$ (E) $x = -\frac{1}{2}$ and $x = -1$

16. Evaluate $\int_1^4 \left(3\sqrt{x} + \frac{4}{x^2}\right)\, dx$ 16._____

(A) 6 (B) 7 (C) 18
(D) 10 (E) 17

17. Let $f(x) = \begin{cases} \dfrac{x^2 - 25}{x - 5}, & \text{if } x \neq 5 \\ k, & \text{if } x = 5 \end{cases}$. Find the value of k so that $f(x)$ is continuous everywhere. 17._____

(A) 25 (B) 10 (C) 5
(D) 0 (E) 1

18. $\int (x^3 + 2x)^5 (12x^2 + 8)\, dx =$ 18._____

(A) $\frac{1}{6}(x^3 + 2x)^6 + C$ (B) $\frac{1}{6}(x^3 + 2x)^6 \frac{1}{2}(12x^2 + 8)^2 + C$ (C) $\frac{1}{2}(12x^2 + 8)^2 + C$

(D) $\frac{2}{3}(x^3 + 2x)^6 + C$ (E) $(x^3 + 2x)^6 + C$

19. If $A = \begin{bmatrix} -1 & 2 \\ 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 3 & 0 \\ 2 & 4 & 5 \end{bmatrix}$, find $AB + B$. 19._____

(A) $\begin{bmatrix} 4 & 6 & 10 \\ 4 & 18 & 35 \end{bmatrix}$
(B) $\begin{bmatrix} 6 & 2 & 10 \\ 6 & 12 & 15 \end{bmatrix}$
(C) $\begin{bmatrix} 4 & 8 & 10 \\ 10 & 20 & 25 \end{bmatrix}$
(D) It does not exist because AB is undefined.
(E) It does not exist because AB and B have different dimensions.

20. Use the definition of the derivative to find 20._____

$$\lim_{\Delta x \to 0} \frac{(x+\Delta x)^{10} - x^{10}}{\Delta x}.$$

(A) 10 (B) $10x^9$ (C) x^9
(D) 0 (E) Does not exist

21. The *difference* of one number x and twice a second number y is 16. What is the minimum possible PRODUCT of x and y? 21._____

(A) -32 (B) -24 (C) 80
(D) 12 (E) -48

22. The function $f(x) = 2x^3 + 3x^2 - 36x$ has a relative *maximum* at 22._____

(A) $x = -3$ (B) $x = -2$ (C) $x = 0$ (D) $x = 2$ (E) $x = 3$

23. A system of linear equations in x, y and z is represented by the augmented matrix 23._____

$$\left[\begin{array}{rrr|r} 1 & -1 & 0 & 5 \\ 0 & 1 & -2 & 10 \\ -2 & 0 & 1 & 0 \end{array}\right]$$

Find the value of z. (Note that you don't need to find x or y, just z.)

(A) $z = 5$ (B) $z = -10$ (C) $z = 15$
(D) $z = \dfrac{10}{3}$ (E) $z = -20$

24. Find the equation of the tangent line to the curve $y = \sqrt{5x-1}$ at the point $(2, 3)$. 24._____

(A) $y - 3 = \dfrac{5}{3}(x-2)$ (B) $y - 3 = \dfrac{5}{6}(x-2)$ (C) $y - 3 = \dfrac{1}{6}(x-2)$
(D) $y - 2 = -\dfrac{5}{6}(x-3)$ (E) $y - 3 = -\dfrac{5}{3}(x-2)$

25. Find the average value of $f(x) = 4x - x^2$ on the interval $0 \le x \le 2$. 25._____

(A) $\dfrac{16}{3}$ (B) 2 (C) 4
(D) 8 (E) $\dfrac{8}{3}$

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26. Given the demand equation $p = 4200 - 1.5x^2$ and the supply equation $p = x^2 + 200$, find the *producer* surplus when the market is in equilibrium. Round your answer to the nearest whole number. 26._____

(A) 64000 (B) 128000 (C) 42667
(D) 85333 (E) 106667

27. Find all solutions (x, y, z) for the system of equations 27._____

$$\begin{array}{rcrcrcl} x & - & 3y & + & z & = & 0 \\ 2x & + & 6y & - & z & = & 9 \\ 3x & + & 3y & & & = & 9 \end{array}$$

(A) $\left(\frac{1}{4} - \frac{9}{4}z,\ -\frac{1}{4} + \frac{3}{4}z,\ z\right)$ for all real numbers z
(B) $\left(\frac{9}{4},\ \frac{3}{4},\ 0\right)$
(C) $\left(\frac{9}{4} + \frac{1}{4}z,\ \frac{3}{4} - \frac{1}{4}z,\ 0\right)$ for all real numbers z
(D) The system has no solutions.
(E) $\left(\frac{9}{4} - \frac{1}{4}z,\ \frac{3}{4} + \frac{1}{4}z,\ z\right)$ for all real numbers z

28. Let $A = \begin{bmatrix} -1 & 2 \\ 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 0 \\ 4 & 5 \end{bmatrix}$. Find a 2×2 matrix X such that $AX = B$. 28._____

(A) $\begin{bmatrix} 1/5 & 2/5 \\ -5 & 5/4 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 5/4 \\ 2 & 5/2 \end{bmatrix}$ (C) $\begin{bmatrix} -4 & 5 \\ 1/5 & 5/4 \end{bmatrix}$
(D) $\begin{bmatrix} -5/4 & 2 \\ 1 & -1/4 \end{bmatrix}$ (E) $\begin{bmatrix} -1 & 5/2 \\ 1 & 5/4 \end{bmatrix}$

29. If $s(t) = e^t - t \ln t - 3t$ represents the position of a particle at time t, find $a(t)$, the acceleration of the particle at time $t = 3$. 29._____

(A) 13.8883 (B) 19.7522 (C) 14.9869
(D) 17.3321 (E) 18.9831

30. Given the marginal cost function $C'(x) = 99x^2 - 24x$, find the cost of producing 6 items if the fixed cost is \$1500. 30._____

(A) \$ 6696 (B) \$ 3420 (C) \$ 8196
(D) \$ 4920 (E) \$ 5196

31. Find the area of the region bounded by $y = x^3 - 4x^2 + 1$ and $y = x - 3$. 31._____

(A) $\frac{253}{12} \approx 21.08$ (B) $-\frac{125}{12} \approx -10.42$ (C) $\frac{211}{12} \approx 17.58$
(D) $\frac{125}{12} \approx 10.42$ (E) $\frac{157}{12} \approx 13.08$

32. If a company sells an item for $p = 75 - .01x$ dollars each, and the cost of manufacturing x items is $C(x) = 1850 + 28x - x^2 + .001x^3$, find the production level which maximizes the profit. Round your answer to the nearest whole number. 32._____

(A) 710 (B) 652 (C) 844
(D) 657 (E) 683

33. Evaluate $\lim_{x \to 3} \frac{x - 3}{\sqrt{x} - \sqrt{3}}$. 33._____

(A) 0 (B) $\sqrt{3} \approx 1.732$ (C) $2\sqrt{3} \approx 3.464$
(D) $-2\sqrt{3} \approx -3.464$ (E) Does not exist

34. For which x-values does the graph of $y = e^{3x^3 - 2x^2 - 4x}$ have a horizontal tangent line? 34._____

(A) $x = 1.215$ and $x = -0.549$
(B) $x = 1.535$
(C) $x = -0.481$ and $x = 0.925$
(D) $x = -0.869$, $x = 0$ and $x = 1.535$
(E) $x = -0.758$ and $x = -0.208$

35. Find the average rate of change of $f(x) = \frac{x^4 - 3x}{\sqrt{x}}$ over the interval $2 \leq x \leq 5$. 35._____

(A) 88.58 (B) 265.73 (C) 288.83
(D) 96.28 (E) 176.25

1. B
2. B
3. A
4. E
5. A
6. A
7. C
8. B
9. A
10. C
11. A
12. B
13. A
14. A
15. D
16. E
17. B
18. D
19. C
20. B
21. A
22. A
23. B
24. B
25. E
26. C
27. E
28. E
29. B
30. C
31. A
32. E
33. C
34. C
35. A