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Rec. Instr. _____

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MATH 205
Exam III
December 12, 2019

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Below you will find 20 problems, each worth 10 points. Solve the problems in the space provided. When writing a solution to a problem, **show all work**. Besides your formula sheet, **no books or notes are allowed**.

Problem 1. Find the zeroes, vertical asymptotes, and horizontal asymptotes:

$$f(x) = \frac{x^2 - 5x + 6}{x^3 + 5x^2 + 6x}$$

Problem 2. Find the zeroes of the polynomial, and the vertex.

$$f(t) = t^4 - 6t^2 + 9$$

Problem 3. Calculate the first and second derivative of

$$p(x) = xe^{3x} + 2x^2 - x + 1$$

Problem 4. Calculate the first derivative of

$$f(x) = \frac{e^{3x+x^2} - 1}{x^2 - 3x}$$

Problem 5. Given the function $f(x) = 3x^2 - 4x + 2$, find the equation of the tangent line to the $f(x)$ at $x = 1$.

Problem 6. Consider the function $f(x) = \sqrt{x}$, approximate $f(8)$ and $f(10)$ using $a = 9$.

Problem 7. Given the function $f(x) = \frac{x^4}{12} - \frac{5x^3}{6} + 3x^2$, find the critical values and classify them using the Second Derivative test, and find the point of inflections, if any.

Problem 8. The profit for sell q danglies is $P(q) = -.02q^2 + 3q + 22$, find the quantity the maximizes profit, justify why it is a maximum.

Problem 9. Given the function $f(x) = 3x - 1$, approximate the area under the curve from $x = 0$ to $x = 5$ using 5 rectangles. Calculate a left hand/ right hand sum, and average.

Problem 10. Integrate the following function

$$\int (x^6 - 3x^2 + e^x) dx$$

Problem 11. Integrate the following function

$$\int (xe^{4x} - x^2) dx$$

Problem 12. Integrate the following

$$\int \ln(5x) dx$$

Problem 13. Integrate the following

$$\int_0^2 (3x^2 - xe^x) dx$$

Problem 14. Find the area between the curves $f(x) = -x^2 + 3$ and $g(x) = 2x^2$ from one intercept to the other.

Problem 15. The marginal cost function of producing q items is given by $MC(q) = -.02q^2 - 3q + 1$, find the total cost of producing 10 items.

Problem 16. The manager at Menards wants to enclose a 500 sq ft rectangular section of the parking lot to showcase new tractors. She wanted to have three sides bordered by Baltic birch at \$8.50 per running foot, and the fourth bordered by cement blocks at \$13 per running foot. Find the dimensions of the least costly such enclosure.

Problem 17. The demand function for Shaki's danglies is given by $q = -35p + 215$. Find the elasticity of demand when $p = \$6$. Should she raise or lower her price to increase revenue?

Problem 18. Consider the following multivariable function

$$f(x, y, z) = x^2z + 3y^2xz^3 - y^3 + e^z - \ln(x^2y^2 - 3y).$$

Find f_x and f_y .

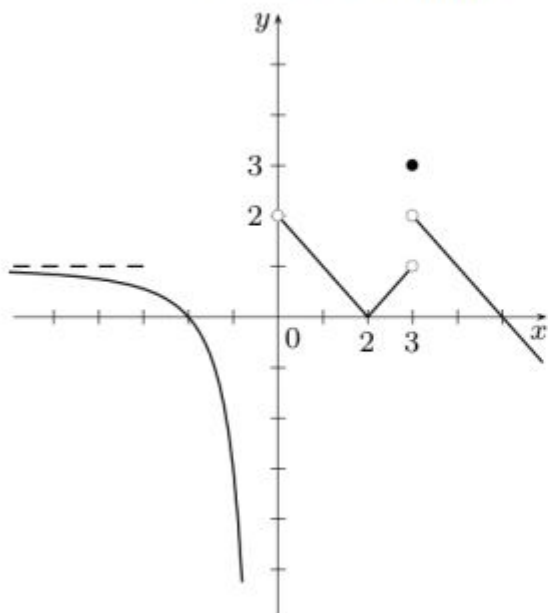
Problem 19. Consider the following multivariable function

$$f(x, y) = xe^{x+y} - 3yx^2 + 2y.$$

Find $f_x, f_y, f_{xx}, f_{yy}, f_{xy}, f_{yx}$

Problem 20. Evaluate the following limits

Use the graph of the function $f(x)$ to answer each question.
Use $\infty, -\infty$ or *DNE* where appropriate.



- (a) $f(0) =$
- (b) $f(2) =$
- (c) $f(3) =$
- (d) $\lim_{x \rightarrow 0^-} f(x) =$
- (e) $\lim_{x \rightarrow 0} f(x) =$
- (f) $\lim_{x \rightarrow 3^+} f(x) =$
- (g) $\lim_{x \rightarrow 3} f(x) =$
- (h) $\lim_{x \rightarrow -\infty} f(x) =$