

- (5pts.) Compute the derivative  $\frac{dy}{dx}$  for  $y = \sqrt{5} + \frac{x^5}{5} - 5 \ln x$ .
- (5pts.) Compute the derivative  $p'(y)$  of the function  $p(y) = \frac{2y+3}{7y+5}$ .
- (5pts.) Write down an equation of the tangent line to the graph of  $y = 1 + 2e^x$  at the point where  $x = 0$ .
- (5pts.) Determine the slope of the tangent line to the graph of the equation  $5x^2 + 3y^2 + xy = 15$  at the point  $(-1, 2)$ .
- (5pts.) Compute the derivative  $\frac{dw}{dz}$  of the function  $w = \sqrt{1 + ze^z}$ .
- (5pts.) Find the limit:

$$\lim_{\theta \rightarrow 0} \frac{3 \sin 4\theta}{5\theta} =$$

- (5pts.) Find the limit:

$$\lim_{x \rightarrow 1} \frac{x^2 - 4x + 3}{x^2 - 1} =$$

- (5pts.) Find the limit:

$$\lim_{x \rightarrow \infty} \frac{6x^2 + 100}{7x^2 - 100} =$$

- (5pts.) For which constant  $k$  is the following function  $Q(x)$  continuous for all  $x$ ? Justify your answer.

$$Q(x) = \begin{cases} x^2 + k & \text{if } x \leq 0 \\ \cos x & \text{if } 0 < x \end{cases}$$

- (6pts.) Show that the derivative of  $f(x) = \frac{1}{x}$  is  $f'(x) = -\frac{1}{x^2}$  by using the definition of the derivative as the limit of a difference quotient.
- (5pts.) If the volume  $V = s^3$  of an expanding cube is increasing at the constant rate of 120 cubic inches per second, how fast is the length  $s$  of the sides increasing when the volume is 8 cubic inches?
- (5pts.) Find where the graph of  $y = x^3 - 6x^2$  is concave up and concave down, and find all inflection points.
- (5pts.) Find and classify all the relative extrema of  $F(x) = x^4 - 4x^2 + 2$ .
- (6pts.) Find the absolute maximum and minimum values of  $f(x) = 4x^3 - 3x^2$  on the closed interval  $[-1, 1]$ .
- (6pts.) A particle moves along the  $x$ -axis with an acceleration given by  $a(t) = 6t + 2$ , where  $t$  is measured in seconds and  $s$  (position) is measured in meters. If the initial position is given by  $s(0) = 3$  and the initial velocity is given by  $v(0) = 4$  then find the position of the particle at  $t$  seconds.
- (5pts.) A rectangular poster is to have an area of 100 square inches with a 1-inch margin on the right and left sides and a 2-inch margin at the top and bottom. Find the dimensions of the poster with the largest printed area.

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17. (4pts.) Write (but DO NOT EVALUATE) a three term Riemann sum for the integral  $\int_0^1 \sqrt{1+x^2} dx$
18. (5pts.) Find the area under the curve  $y = 5 - 2x^2$  from  $x = 0$  to  $x = 1$
19. (4pts.) Evaluate the derivative  $F'(x)$  of the function  $F(x)$  defined by:

$$F(x) = \int_0^x \frac{1}{\sqrt{1+t^3}} dt$$

at  $x = 2$ .

20. (4 pts.) Evaluate  $\int x \sin(x^2) dx$