

King Fahd University of Petroleum and Minerals
Department of Mathematics & Statistics
Math 101(22&31) Class Test III (A) Fall 2016(161)

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(1) (a) For what values of x is the function $f(x) = |x^2 + x|$ differentiable?
Find a formula for f' . (b) Sketch the graphs of f and f' .

(2) Find $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ for $f(x) = x^2 e^{2x}$.

(3) Compute the sum $a + b$ if the normal line to the curve $x^2 + xy + y^2 = 3$ at $(1, 1)$ intersects the curve at another point (a, b) .

(4) Find y' of each of the following:

(a) $y = \frac{1}{1-\frac{1}{x}}$.

(b) $y = \sqrt{x \sin \sqrt{x}}$.

(c) $\tan(xy) = x^2 - y$.

(d) $y = \left(\frac{x}{4} + x^{-5}\right)^{\frac{1}{2}}$

$$(e) y = \sec^2(\log_4 x^4) \tan^3(\log_{16} x^4) + \log_2(8x^{\ln 2}).$$

$$(f) y = \sqrt{\sin(7x + \cos 5x)} + \tan^3 \sqrt{\cot 7x}.$$

$$(g) y = \sin^{-1}\left(\frac{x-4}{x+4}\right) + \tan^{-1}(\ln \sqrt{x}), x > 0.$$

(5) Find the local linear approximation of $f(x) = e^{\tan^{-1}(3x)}$ at $x_0 = 0$, and use it to approximate $f(.001)$.

(6) Find the number of points at which the curve $y = x^3 - 3x^2 + 4$ has tangent lines parallel to the line $3x + y = 2$.

(7) A man walks along a straight path at a speed of 4 ft/s. A searchlight is located on the ground 20 ft from the path and is kept focused on the man. At what rate is the searchlight rotating when the man is 15 ft from the point on the path closest to the searchlight?

(8) The position function of a body moving in a straight line is $s(t) = t^3 - 6t^2 + 9t$, $t \geq 0$. Determine the times where the body changes direction.

(9) Find $\frac{df^{-1}}{dx}|_{x=-2}$ if $f(x) = 1 + 2x - x^2$, $x \leq 1$ without evaluating the inverse function $f^{-1}(x)$.

(10) Find y'' if $y = 5x^5 - y^5 - 1$.

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