Review Problems for exam 2

Note: these problems are an addition to the written homework and webwork problems.

You can watch the solutions for the problems with (*) on the posted streaming power points.

1. Use implicit differentiation to find the equation of the tangent line to the curve at the given point.

(a*) $x^3 - y^3 = \cos xy + 7$, $(0, -2)$ $\qquad\qquad$ (b) $x^3 + y^3 - \dfrac{9}{2}xy = 0$, $(2, 1)$

2*. if $y = x^{x^2}$ find $\dfrac{dy}{dx}$

3. Find the absolute maximum and absolute minimum values of the function on the given interval.

(a) $f(x) = 2x^3 - 3x^2 - 12x + 1$, $[-2, 3]$ $\qquad\qquad$ (b*) $f(x) = xe^{-x}$, $[0, 2]$

4. For a given function: find its domain, its vertical and horizontal asymptotes (if any), where it is increasing and decreasing and where it is concave up and down. Find all local maximum and minimum and all inflection points. Use this information to sketch the graph of the function.

(a*) $f(x) = \dfrac{2x - 6}{x - 1}$ $\qquad\qquad$ (b*) $f(x) = x \ln x$ $\qquad\qquad$ (c) $f(x) = xe^x$

5. Evaluate each of the following limits.

(a*) $\displaystyle\lim_{x\to\infty} \dfrac{\sqrt{9x^6 - x}}{x^3 + 1}$ $\qquad$ (b*) $\displaystyle\lim_{x\to-\infty} \dfrac{\sqrt{9x^6 - x}}{x^3 + 1}$ $\qquad$ (c) $\displaystyle\lim_{x\to1} \dfrac{x^7 - 1}{x^3 - 1}$.

(d*) $\displaystyle\lim_{x\to\infty} \dfrac{\ln(\ln x)}{x}$ $\qquad$ (e*) $\displaystyle\lim_{x\to0^+} \dfrac{\ln x}{x}$ $\qquad$ (f*) $\displaystyle\lim_{x\to\infty} \left(1 + \dfrac{1}{2x}\right)^{3x}$

(g) $\displaystyle\lim_{x\to\infty} \left(\sqrt{x^2 + x} - 3x\right)$ $\qquad\qquad$ (h) $\displaystyle\lim_{x\to\infty} \dfrac{\cos x - 1}{x^2}$

6. Use differentials or linear approximation to find an approximated value for

(a*) $\sqrt{8.99}$ $\qquad\qquad$ (b) $\dfrac{1}{\sqrt[3]{8.2}}$ $\qquad\qquad$ (c) $\sin 0.02$

7. A function $g(x)$ is differentiable for all real numbers. $g(-3) = 5$ and for all x, $g'(x) > 2$. Is this true that $g(4) = 17$? Explain!

8. Find the horizontal and vertical asymptotes of the graph of

(a*) $f(x) = \dfrac{e^{2x} + 4}{e^{2x} - 5}$ $\qquad\qquad$ (b) $g(x) = \dfrac{e^{2x} + 2}{e^{3x} - 1}$

9*. Water is pumped into inverted cone with a radius and height of 12 ft. at the rate of 3 cubic feet per hour. How fast is the water level raising when the height of the water level is 2 ft?

Hint: the height and the radius of the water level is always equal.

10*. Find the point on the curve $y = \sqrt{x^2 - x + 3}$ which is closest to the point $(1, 0)$.

11*. A farmer needs to fence in a rectangular field containing an area of $1,200$ square meters along a river. If the field has a fence down the middle parallel to one side and perpendicular to the river, what is the smallest amount of fence that he can use?

Note: there is no need to fence the side along a river.

12*. A screen saver is of a shape of a circular ring. At a certain time, the inner radius is 5 inches and it is increasing at the rate of 2 inches per second while the radius of the outer circle is 20 inches and decreasing at the rate of 3 inches per second. How fast is the area of the ring changing at this instant? Is it increasing or decreasing?

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