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MTH 111, Exam 2

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$$SCORE = \frac{46}{46}$$

QUESTION 1. (12 points). Find y' and do not simplify

(i) $y = \frac{4}{x^2} + \sqrt{x} + 3x + 1$

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

$f'(x) = -8x^{-3} + \frac{1}{2}x^{-\frac{1}{2}} + 3$

(ii) $y = (2x^3 + 6x - 4)^6$

$y' = 6(2x^3 + 6x - 4)^5 \cdot (6x^2 + 6)$

(iii) $y = ln(5x + 12) + e^{(3x^2+7x)}$

$\frac{5}{5x+12} + e^{(3x^2+7x)} \cdot (6x + 7)$

(iv) $y = ln\big((3x + 2)^3(7x + 2)^6\big)$

$\ln(3x+2)^3 + \ln(7x+2)^6$

$3\ln(3x+2) + 6\ln(7x+2)$

$\frac{3(3)}{3x+2} + \frac{6(7)}{7x+2} \rightarrow \frac{9}{3x+2} + \frac{42}{7x+2}$

QUESTION 2. (4 points). Let $f(x) = k(3x^2+x-1)$ and $k'(9) = -3$. Find $f'(-2)$.

$f'(x) = k'(3x^2 + x - 1) \cdot (6x + 1)$

$f'(-2) = k'(3(-2)^2 + (-2) - 1) \cdot (6(-2) + 1)$

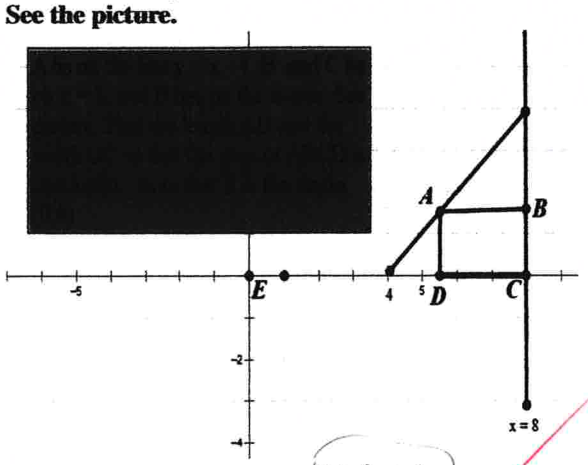
$\rightarrow k'(9) \cdot -11$

$-3 \cdot -11$

33

QUESTION 3. (8 points).
See the picture.

[redacted]



A lies on $y = x-4$

B lies on $x = 8$

C .... $x = 8$

D .... x axis

$E = (0,0)$

$8-(4-x)$

$L = X$

$w = x-4$

$a(x) = x(4-x)$

$= 4x - x^2$

$A'(x) = 4 + 2x$

$4 + 2x = 0$

$\frac{2x}{2} = \frac{-4}{2}$

$\boxed{x = 2}$

$2 > 0$

therefore there isnt a max

$2 \times 2 = 4$

$8-(4-(2))$

↳ $w = 2$

$L = 2$

QUESTION 4. (8 points).
See the picture.

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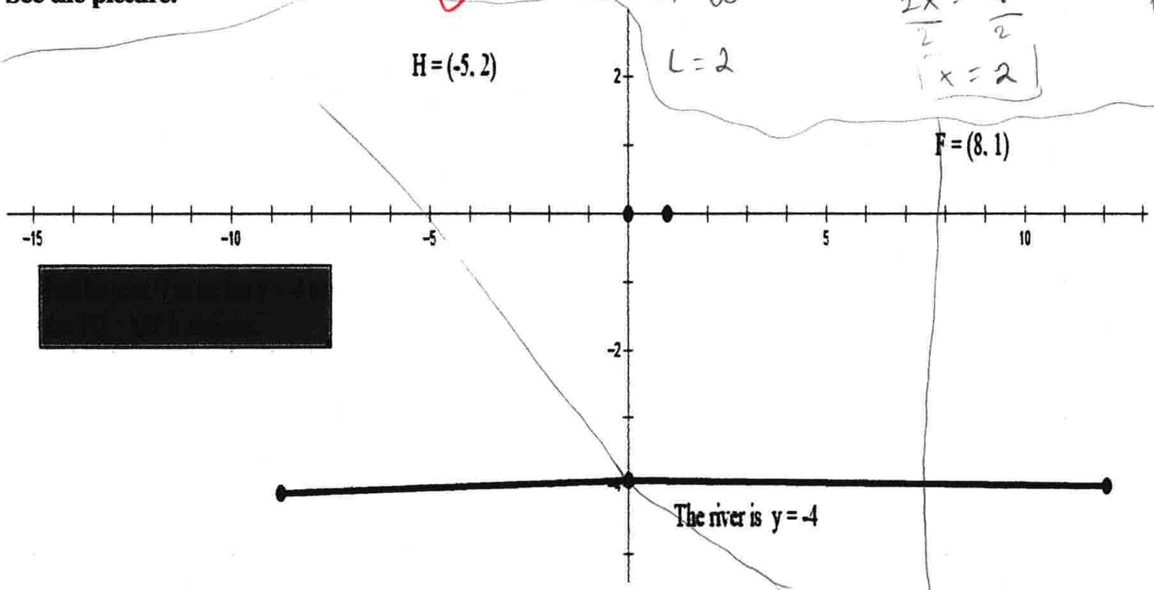


Find Q on $y = -4$ such that $|FQ|+|QH|$ is minimum.

$y = mx+b$

$m = \frac{-9-2}{8--5} = \frac{-11}{13}$

$y = -\frac{11}{13}x + b$

$2 = -\frac{11}{13}(-5) + b$

$2 - \frac{55}{13} = b$

$b = -\frac{29}{13}$

$-4 = -\frac{11}{13}x - \frac{29}{13}$

$\frac{11}{13}x = 4 - 29$

$-4 = \frac{-11}{13}x - \frac{29}{13}$

$x = \frac{23}{11}$

$H' = (-5, -10)$

$Q = (\frac{23}{11}, -4)$

QUESTION 5. (6 points). Let $f(x) = ln(2x-5) + 2e^{(3x-9)} + 2x + 1$. Find the equation of the tangent line to the curve of $f(x)$ when $x = 3$.

$f(x) = \ln(2x-5) + 2e^{(3x-9)} + 2x + 1$

$Q = (3, f'(3))$

$(3, 10)$

$f'(x) = \dfrac{2}{2x-5} + 2e^{(3x-9)} \cdot (3) + 2$

$f'(3) = \dfrac{2}{2(3)-5} + 2e^{(3(3)-9)} \cdot (3) + 2 = 10$

$9 = 10(3) + b$

$9 = 30 + b$

$-21 = b$

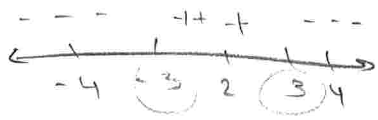
$f(3) = \ln(2(3)-5) + 2e^{(3(3)-9)} + 2(3) + 1 = 9$

$\boxed{y = 10x - 21}$

QUESTION 6. (8 points). Let $f(x) = -x^3 + 27x - 12$.

(i) Find the sign of $f'(x)$.

$f'(x) = -3x^2 + 27$



$-3x^2 + 27 = 0$

$\dfrac{-3x^2}{-3} = \dfrac{-27}{-3}$

$\sqrt{x^2} = \sqrt{9}$

$x = -3$

$x = 3$

(ii) Stare at (i), for what values of x does $f(x)$ increase?

$]-3, 3[$

(iii) Stare at (i), for what values of x does $f(x)$ decrease?

$]-\infty, -3[\cup]3, \infty[$

(iv) Stare at (i), roughly, sketch the curve of $f(x)$.

local min = -3

local max = 3