[24] 1. Compute the following limits. If the limit does not exist, explain why. Do not use L'Hopital's rule.

a) $\lim_{t\to\infty} \frac{t^2+2t+1}{3-4t^2}$

b) $\lim_{x\to -1} \frac{3x}{(x+1)^3}$

c) $\lim_{u\to 2} \frac{\sqrt{4u+1}-3}{u-2}$

d) $\lim_{x\to 0} \frac{\tan 3x}{\sin x}$

[10] 2. Suppose $f(x) = x^2 - 2x$. Find $f'(x)$ from the DEFINITION of the derivative.

[35] 3. Find $f'(x)$ for the following functions. You need not simplify your answers.

a) $f(x) = 7x^{2/7} - 5x^{7/2}$

b) $f(x) = (1 + 5x^4)^{-4}(1 - x^3)^3$

c) $f(x) = \left(1 + 2e^{2x} + \sin 3x - \dfrac{1}{x^2}\right)^{3/5}$

d) $f(x) = (x+1)^{\cos x}$

e) $f(x) = \displaystyle\int_{e^{2x}}^{\sqrt{7}} \sin t^2 \, dt$

[11] 4. Find dy/dx by implicit differentiation if $\sqrt{x^2 + y^2} = x + \cos y$.

[10] 5. Find an equation of *the* tangent line to $f(x) = xe^{\sin x}$ at the point $x = \frac{\pi}{2}$.

[12] 6. Find the absolute maximum and absolute minimum of $f(x) = x^3 - 3x^2 + 1$ on $\left[\frac{1}{2}, 4\right]$.

[10] 7. A street light is mounted at the top of a 15-ft-tall pole. A man 6 ft tall walks away from the pole with a speed of 5 ft/s along a straight path. How fast is the tip of his shadow moving when he is 40 ft from the pole?

[10] 8. A farmer has 2400 ft of fencing and wants to fence off a rectangular field that borders a straight river. He needs no fence along the river. What are the dimensions of the field that has the largest area?

[28] 9. Evaluate the following indefinite integrals.

a) $\int 3\sqrt{x}(x^2 + 6\pi + x^{-1})dx$

b) $\int \left(e^{-2x} + 8\sin 4x - 5\cos 4x\right) dx$

c) $\int \frac{x}{\sqrt{x+1}}dx$

d) $\int \frac{\sin 2x}{1+\cos 2x}dx$

[20] 10. Find the following definite integrals.

a) $\int_{1}^{2} (8x^3 + 3x^2)dx$

b) $\int_{e}^{e^4} \frac{dx}{x\sqrt{\ln x}}$

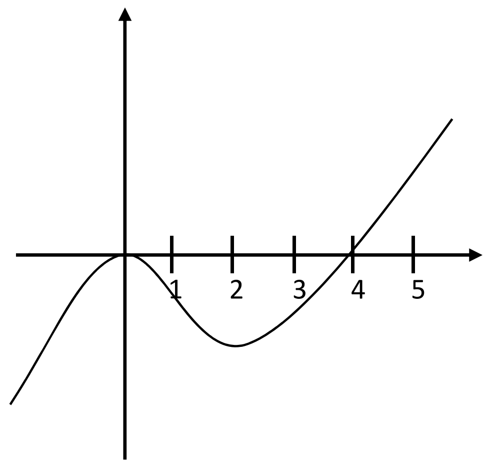
[15] 11. Let R be the region bounded by $y = x^3$ and $y = \sqrt{x}$. Find the following.

a) Area of R.

b) Volume of the solid obtained by rotating R about the line $y = 1$. SETUP ONLY.

c) Volume of the solid obtained by rotating R about the line $x = 1$. SETUP ONLY.

[15] 12. Suppose that the DERIVATIVE f' of a function f has the graph



This graph is not the graph of the function. It is the graph of the derivative of f.

a) Find the intervals where f is increasing/decreasing.

b) Find the intervals where f is concave up/down.

c) Assuming $t(2) = 0$, sketch a graph of f. Clearly label minima, maxima and inflection points.