# PART TWO

Please show all of your work.

9) Find the equation of the tangent line to $x^3 + 5x^2y - y^3 = 19$ at the point $(2,1)$

Answer (8 points)

Please show all of your work

10) A rectangle is inscribed between the *x*-axis and the curve $y = 27 - x^2$, with its base on the *x*-axis and two vertices touching the curve. Find the area of the largest possible rectangle.

Answer (10 points)

Stony Brook University MAT 125 – Calculus A

Dept. of Mathematics Final Exam December 14, 2016

Please show all of your work.

11) Evaluate $\lim_{x\to 0}\dfrac{\sqrt{1+x}-1}{x}$

Answer (4 points)

12) Find $f'(x)$ if $f(x)=\ln\left[\dfrac{(3x^2-5)^2}{(4x^2+5)^3}\right]$

Answer (4 points)

Please show all of your work.

13) A rectangular box with a square base and no top is to be constructed so as to hold $32\,in^3$. Find the dimensions that minimize the surface area of the box. Justify that you have found the minimum and not the maximum.

Answer (12 points)

Please show all of your work

14) Find $\frac{d^2y}{dx^2}$ if $y^3 + y = x^2 - x$

Answer (8 points)

Please show all of your work

15) The volume of a sphere is increasing at $24\pi\ cm^3 / s$.

a) How fast is the radius increasing when the radius is 6 $cm$?

Answer (5 points)

b) How fast is the surface area increasing at that time?

Answer (3 points)

Please show all of your work

16) Given $y = x^3 - 6x^2 - 36x + 4$:

a) For what values of $x$ is $y$ decreasing?

b) What is the $x$-coordinate of the local minimum?

c) What is the $x$-coordinate of the point of inflection?

d) On the next page, sketch the curve, labeling what you believe is appropriate.

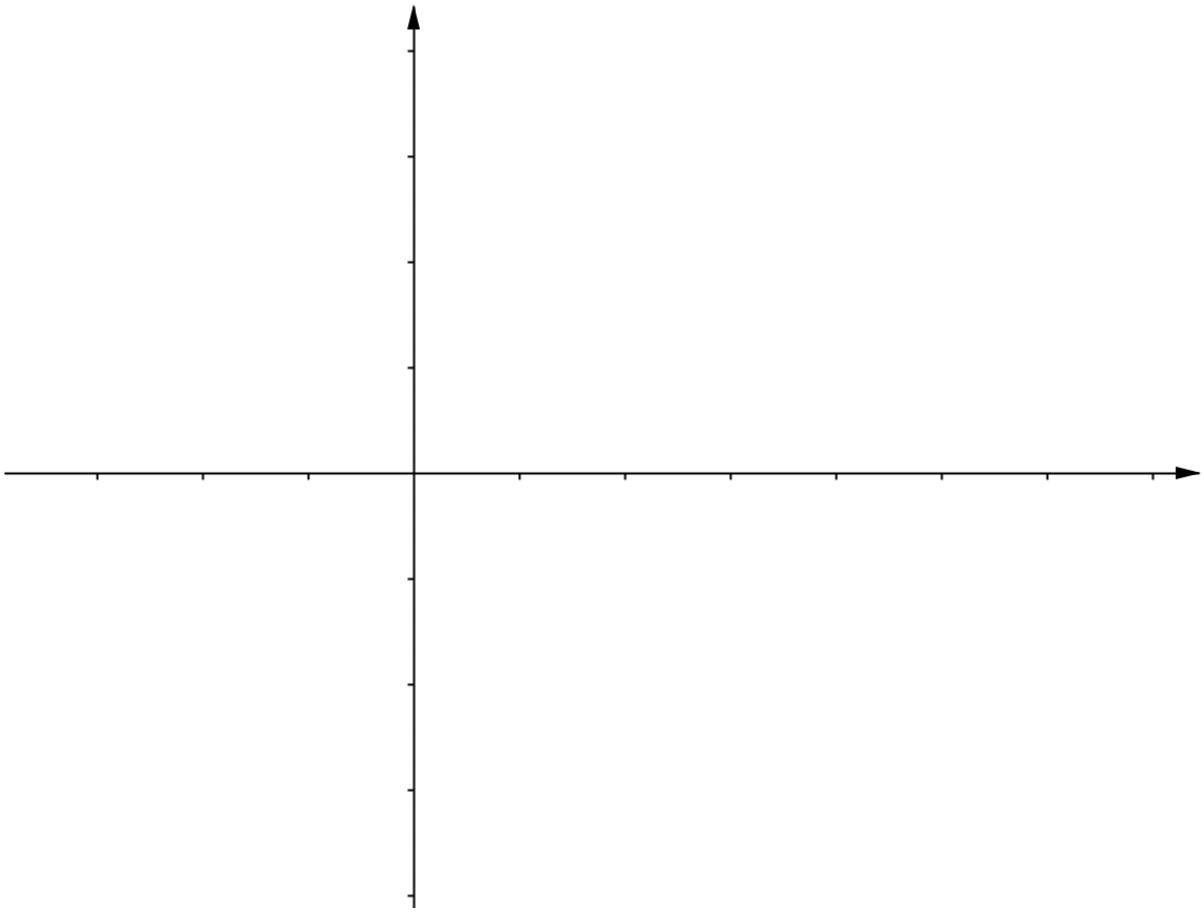
Answer (6 points)

a)

b)

c)

d) Answer (4 points)



Please show all of your work

17) A conical tank is buried point down in the ground. Its diameter is 8 meters and its height is 24 meters. It is being filled with crude oil at $12\pi\ m^3 / hour$. How fast is the height of the oil in the tank rising when the height of the oil is 6 meters?

Answer (12 points)

## Extra credit:

Find $f^{(20)}(x)$ if $f(x) = x^{19}$ .

Answer (4 points)