Find the derivative:

1) $y = (x^4 - 3x^2 + 5)^3$

2) $y = \cos(\tan x)$

3) $y = 2x\sqrt{x^2 + 1}$

4) $y = \left(x + \dfrac{1}{x^2} \right)^{\sqrt{7}}$

5) If $f(t) = \sqrt{4t + 1}$ find $f''(2)$

6) If $g(\theta) = \theta \sin\theta$, find $g''(\pi/6)$

7) Find the equations of the tangent and normal lines to the curve at the point: (2, 1)

$x^2 + 4xy + y^2 = 13$

8) Find the points on the ellipse $x^2 + 2y^2 = 1$ where the tangent line has slope of 1.

9) A particle moves on a vertical line so that its coordinate at time t is $y = t^3 - 12t + 3, t \geq 0$.

    a) Find the velocity and acceleration functions.

    b) When is the particle moving upward and when is it moving downward?

    c) Find the distance that the particle travels in the time interval [0, 3].

    d) Graph all three functions over the same time interval.

    e) When is the particle speeding up? Slowing down?

10) Find $f(x)$ if: $f'(x) = 8x - 3\sec^2 x$

11) Find $f(x)$ if: $f'(x) = 2x - 3\sin t$

12) Differentiate: $F(x) = \displaystyle\int_{2x}^{3x+1} \sin(t^4)\, dt$

13) Differentiate: $y = (\cos x)^x$

Integrate:

14) $\int \sin \pi t \cos \pi t \, dt$

15) $\int_0^2 y^2 \sqrt{1 + y^3} \, dy$

16) $\int \dfrac{1}{16 + t^2} \, dt$

17) $\int \dfrac{\cos(\ln x)}{x} \, dx$

18) $\int \dfrac{x + 1}{x^2 + 2x} \, dx$

19) $\int_0^1 \dfrac{e^x}{1 + e^{2x}} \, dx$

Find the area enclosed by the curves. Draw a picture! No calculators!

20) $y = \sin x, \, y = 0, \, x = \pi/2, \, x = \pi$

21) $y = x^2 - 2x, \, y = x + 4$

Find the volume of the solid rotated about the given line. Sketch all regions!! NO Calculators!

22) $y = 4(x - 2)^2, \, y = x^2 - 4x + 7$, about the x-axis

23) $y^2 = x, \, x = 2y$, about the y-axis