**Mathematics 141 Test #3** Name:______________________________

**Show your work to get credit.** An answer with no work will not get credit.

(1) (30 points) Compute the following antiderivatives.

(a) $\int (4x^5 + 2x^3 - 2x^2 + 4x - 5)\, dx$ ____________________

(b) $\int (3\cos\theta + 4\sin\theta)\, d\theta$ ____________________

(c) $\int \sqrt{t}\, dt$ ____________________

(d) $\int \frac{7}{y^4}\, dy$ ____________________

(e) $\int \frac{3s^2 - 4s}{s^4}\, ds$ ____________________

(f) $\int x\sqrt{x^2 + 4}\, dx$ ____________________

(g) $\int \frac{\sin\theta}{(2 + \cos\theta)^3}\, d\theta$ ____________________

(h) $\int (y^2 + 1)\sqrt{y^3 + 3y + 1}\, dy$ ____________________

(2) (20 points) Compute the following definite integrals.

(a) $\int_0^2 (3x^2 + 2x + 1)\, dx$ ____________________

(b) $\int_0^4 \sqrt{4t+1}\, dt$ ____________________

(c) $\int_0^\pi \sin(\theta/2)\, d\theta$ ____________________

(d) $\int_{-1}^2 \frac{5x\, dx}{(x^2+1)^3}$ ____________________

(3) (5 points) Find the function $F(x)$ such that $F'(x) = 2 + 4x^3$ and $F(1) = 5$.

$F(x) =$ ____________________

(4) (5 points) Solve $\dfrac{dy}{dx} = -\dfrac{2x}{3y}$, and $y(1) = 2$. ________________________

(5) (5 points) Compute $\sum_{k=2}^{5} 3k - 2$. ________________________

(6) (10 points)

(a) State the mean value theorem.

(b) Show that $|\cos(3b) - \cos(3a)| \leq 3|b - a|$.

(7) (5 points) Let $f(x) = \begin{cases} x, & 0 \leq x \leq 2; \\ 4 - x, & 2 < x < 6. \end{cases}$ Then find $\int_0^6 f(x)\, dx$. ________________________

(8) (10 points)

(a) State the first form of the Fundamental Theorem of Calculus.

(b) Compute the following:

(i) $\frac{d}{dx}\int_4^x \sin(t^2)\,dt$ ____________________

(ii) $\frac{d}{dx}\int_3^{x^2+1} \sin(t)\,dt$ ____________________

(9) (10 points) Find the area between the curves $y = 2x$ and $y = x^2$. HINT: Draw the graph and see where the two curves intersect.

Area= ____________________

(10) (5 points) If $a$ is a constant, then compute $\int_0^a (a-x)^4\,dx$