NAME: ______________________________

Math 163 (Cowen) **Make-up Test 4** **18 April 2008**

There are 5 pages, 20 questions, and 100 points on this test. No partial credit!

You will have 1 hour to complete this test!

For each question, find an anti-derivative, an indefinite integral, or the definite integral, as indicated.

(10 points) **1.** $f'(x) = 4x^5 - 8.1x^2 + 14.4x + 13.7$

$f(x) =$ $\frac{4}{6}x^6 - \frac{8.1}{3}x^3 + \frac{14.4}{2}x^2 + 13.7x + C$

(10 points) **2.** $g'(t) = 7\sqrt{t^5} - \frac{5}{\sqrt[3]{t}} + \frac{8}{t^4}$ $= 7t^{5/2} - 5t^{-1/3} + 8t^{-4}$

$g(t) =$ $\frac{7}{\frac{7}{2}}t^{7/2} - \frac{5}{\frac{2}{3}}t^{2/3} + \frac{8}{-3}t^{-3} + C$

(10 points) **3.** $h'(r) = \frac{r^5 - 2r^4 + 5}{r^3}$ $= r^2 - 2r + 5r^{-3}$

$h(r) =$ $\frac{1}{3}r^3 - r^2 + \frac{5}{-2}r^{-2} + C$

(10 points) **4.** $R'(\theta) = 4\sin\theta - 2(\sec\theta)^2$

$R(\theta) =$ $-4\cos\theta - 2\tan\theta + C$

(10 points) **5.** $\int x^5 - 6x + 3\,dx =$

$$\frac{1}{6}x^6 - \frac{6}{2}x^2 + 3x + C$$

(10 points) **6.** $\int r^2(2r^3 - 3)\,dr = \int 2r^5 - 3r^2\,dr$

$$= \frac{2}{6}r^6 - r^3 + C$$

(10 points) **7.** $\int \frac{4y^4 - 3y + 5}{\sqrt{y}}\,dy = \int 4y^{7/2} - 3y^{1/2} + 5y^{-1/2}\,dy$

$$= \frac{4}{\frac{9}{2}}y^{9/2} - \frac{3}{\frac{3}{2}}y^{3/2} + \frac{5}{\frac{1}{2}}y^{1/2} + C$$

(10 points) **8.** $\int 5\cos\theta - 3\sec\theta\tan\theta\,d\theta = 5\sin\theta - 3\sec\theta + C$

(10 points) **9.** $\int (5-4z)^6\,dz =$

$$\int u^6\left(-\frac{1}{4}\right)du = -\frac{1}{4}\,\frac{1}{7}\,u^7 + C$$

$u = 5-4z$

$du = -4dz$

$-\frac{1}{4}du = dz$

$$= -\frac{1}{4}\left(\frac{1}{7}\right)(5-4z)^7 + C$$

(10 points) **10.** $\int (y^3+1)^6 y^2\,dy =$

$$\int u^7\left(\frac{1}{3}\right)du = \frac{1}{3}\,\frac{1}{8}\,u^8 + C$$

$u = y^3+1$

$du = 3y^2dy$

$\frac{1}{3}du = y^2dy$

$$= \frac{1}{3}\left(\frac{1}{8}\right)(y^3+1)^8 + C$$

(10 points) **11.** $\int x^2\sqrt[3]{x^3+4}\,dx =$

$$\int u^{1/3}\,\frac{1}{3}du = \frac{1}{3}\,\frac{1}{\frac{4}{3}}\,u^{4/3} + C$$

$u = x^3+4$

$du = 3x^2dx$

$\frac{1}{3}du = x^2dx$

$$= \frac{1}{4}(x^3+4)^{4/3} + C$$

(10 points) **12.** $\int 5\cos 4t - 6\sec 2t\tan 2t\,dt =$

$$\frac{5}{4}\sin 4t - \frac{6}{2}\sec 2t + C$$

do the substitutions mentally

(10 points) **13.** $\int 4x^2 \sin(x^3+4)\,dx =$

$$-\frac{4}{3}\cos(x^3+4) + C$$

(10 points) **14.** $\int \frac{4}{(2r-5)^3}\,dr =$ $\int 4(2r-5)^{-3}dr$

$$= \left(\frac{4}{-2}\right)\left(\frac{1}{2}\right)(2r-5)^{-2} + C$$

(10 points) **15.** $\int_{-2}^{2} y^2 + 5y + 3\,dy =$ $\frac{1}{3}y^3 + \frac{5}{2}y^2 + 3y \Big|_{-2}^{2}$

$$= \left(\frac{8}{3} + \frac{5}{2}4 + 6\right) - \left(\frac{1}{3}(-2)^3 + \frac{5}{2}(-2)^2 + 3(-2)\right)$$

(10 points) **16.** $\int_{-\pi}^{\pi} \cos\frac{t}{2}\,dt =$ $2\sin\frac{t}{2}\Big|_{-\pi}^{\pi} = 2\sin\frac{\pi}{2} - 2\sin\left(\frac{-\pi}{2}\right)$

$$= 4$$

(10 points) **17.** $\int_0^1 \sqrt{3a+1}\,da =$ $\int_0^1 (3a+1)^{1/2} da = \frac{1}{3}\frac{1}{\frac{3}{2}}(3a+1)^{3/2}\Big|_0^1$

$= \frac{2}{9}4^{3/2} - \frac{2}{9}1^{3/2} = \frac{14}{9}$

(10 points) **18.** $\int_2^4 \frac{y}{(y^2-1)^2}\,dy =$ $\int_2^4 y\,(y^2-1)^{-2} dy = -\frac{1}{2}(y^2-1)^{-1}\Big|_2^4$

$= -\frac{1}{2}(16-1)^{-1} - \left(-\frac{1}{2}(4-1)^{-1}\right)$

(10 points) **19.** $\int_{z=-1}^{z=3} (z+1)(z^2+2z)^2\,dz =$ $\int_{u=-1}^{u=15} u^2\left(\left(\frac{1}{2}\right)du\right) = \frac{1}{2}\frac{1}{3}u^3\Big|_{-1}^{15}$

$u = z^2+2z$

$du = (2z+2)dz$

$\frac{1}{2}du = (z+1)dz$

$u = 15$ when $z=3$

$u = -1$ when $z=-1$

$= \frac{1}{6}15^3 - \left(\frac{1}{6}(-1)^3\right)$

(10 points) **20.** $\int_{\theta=0}^{\theta=\pi/2} \sin\theta(\cos\theta)^4\,d\theta =$ $\int_{u=1}^{u=0} u^4(-du) = -\frac{1}{5}u^5\Big|_1^0 = \left(-\frac{1}{5}0^5\right) - \left(-\frac{1}{5}(+1)^5\right)$

$u = \cos\theta$

$du = -\sin\theta\, d\theta$

$= \frac{1}{5}$

$u = 0$ when $\theta = \frac{\pi}{2}$

$u = 1$ when $\theta = 0$