**Directions:**

1. Write your name with one character in each box below.
2. Show all work. No credit for answers without work.

1. **[4 parts, 1 point each]** Compute the derivatives of the following functions.

(a) $f(x) = \cos(1)$

constant function

$$\frac{d}{dx}\left[\cos(1)\right] = 0$$

(b) $g(t) = \frac{2t+2}{t+2}$

$$g'(t) = \frac{(t+2)\frac{d}{dx}\left[2t+2\right] - (2t+2)\frac{d}{dx}\left[t+2\right]}{(t+2)^2}$$

$$= \frac{2(t+2) - (2t+2)}{(t+2)^2} = \boxed{\frac{2}{(t+2)^2}}$$

(c) $u(z) = \tan^3(z^2)$

$$\frac{du}{dz} = 3\tan^2(z^2)\cdot\frac{d}{dz}\left[\tan(z^2)\right]$$

$$= 3\tan^2(z^2)\cdot\sec^2(z^2)\cdot\frac{d}{dz}\left[z^2\right]$$

$$= 3\tan^2(z^2)\sec^2(z^2)\cdot 2z$$

$$= \boxed{6z\tan^2(z^2)\sec^2(z^2)}$$

(d) $h(y) = \ln(\sqrt{y})$

$$= \ln(y^{\frac{1}{2}}) = \frac{1}{2}\ln y$$

$$\frac{d}{dy}\left[\frac{1}{2}\ln y\right] = \frac{1}{2}\cdot\frac{1}{y} = \boxed{\frac{1}{2y}}$$

2. **[4 parts, 1 point each]** Compute the following indefnite integrals.

(a) $\int \frac{1}{2z}\,dz = \frac{1}{2}\int\frac{1}{z}\,dz$

$$= \boxed{\frac{1}{2}\ln|z| + C}$$

(b) $\int \sec^2 x\,dx$

$$= \boxed{\tan x + C}$$

(c) $\int \csc x \cot x\,dx = \boxed{-\csc x + C}$

(d) $\int (y+2)(y^2-1)\,dy = \int y^3 - y + 2y^2 - 2\,dy$

$$= \int y^3 + 2y^2 - y - 2\,dy =$$

$$= \boxed{\frac{1}{4}y^4 + \frac{2}{3}y^3 - \frac{1}{2}y^2 - 2y + C}$$

3. **[2 points]** Find the number $b$ so that the area under the curve $y = x^2$ from $x = 1$ to $x = b$ is exactly 1.

Set (Area under the curve) = 1 and solve for $b$:

$$\int_1^b x^2\,dx = 1$$

$$\frac{1}{3}x^3\Big|_1^b = 1$$

$$\frac{1}{3}b^3 - \frac{1}{3} = 1$$

$$\frac{1}{3}(b^3 - 1) = 1$$

$$b^3 - 1 = 3$$

$$b^3 = 4$$

$$\boxed{b = 4^{1/3}}$$