MTH151 - Practice Quiz #1 Name: Soln

For full credit, you must show all work and circle your final answer.

1 Use the fundamental theorem of calculus to find the derivative of the given function.

$$h(x) = \int_1^{\sqrt{x}} \frac{z^2}{z^4+1}\, dz$$

Let $u = \sqrt{x}$

$$\frac{d}{dx}\left[\int_1^{\sqrt{x}} \frac{z^2}{z^4+1}\, dz\right] = \frac{d}{dx}\left[\int_1^{u} \frac{z^2}{z^4+1}\, dz\right] = \frac{d}{du}\left[\int_1^{u} \frac{z^2}{z^4+1}\, dz\right]\cdot\frac{du}{dx}$$

$$= \frac{u^2}{u^4+1}\cdot\frac{du}{dx} = \frac{x}{x^2+1}\cdot\frac{1}{2}x^{-1/2}$$

2 Find the general indefinite integral.

$$\int \left(\frac{1+r}{r}\right)^2 dr$$

$$\int \left(\frac{1+r}{r}\right)^2 dr = \int \left(\frac{1}{r}+1\right)^2 dr = \int \left(\frac{1}{r^2} + \frac{2}{r} + 1\right) dr$$

$$= \frac{-1}{r} + 2\ln|r| + r + C$$

3 Use a substitution to evaluate the following indefinite integral.

$$\int \cos^3(\theta)\sin(\theta)\, d\theta$$

Let $u = \cos\theta$ $du = -\sin\theta\, d\theta$

$$\int \cos^3(\theta)\sin\theta\, d\theta = -\int u^3\, du = -\frac{u^4}{4} + C$$

$$= -\frac{\cos^4(\theta)}{4} + C$$