Math 142 – Quiz 2 – Solutions

1. (a) $g'(x) = -(x^2-1)e^{-x^2}$

   (b) $g'(x) > 0$ when $-(x^2-1) > 0$ or $x^2 < 1$, thus for $x \in [0,1)$.

2.

   (a) $\int \cos^2 3x\, dx = \frac{1}{2}x + \frac{1}{12}\sin 6x + C$

   Trig identity $\cos^2\theta = \frac{1}{2}(1+\cos 2\theta)$ and sub $u = 6x$

   (b) $\int s^2 e^{2s}\, ds = (\frac{1}{2}s^2 - \frac{1}{2}s + \frac{1}{4})e^{2s} + C$ Integration by parts twice

   (c) $\int 3x(2-4x^3)^2\, dx = 6x^2 - \frac{48}{5}x^5 + 6x^8 + C$ Multiply out

   (d) $\int \frac{\sin\sqrt{x}}{\sqrt{x}}\, dx = -2\cos\sqrt{x} + C$ Sub $u = \sqrt{x}$

   (e) $\int t\sqrt{1-t}\, dt = -\frac{2}{3}(1-t)^{3/2} + \frac{2}{5}(1-t)^{5/2} + C$

   Sub $u = 1-t$ or integration by parts $u = t$, $dv = \sqrt{1-t}dt$

   (f) $\int \ln x\, dx = x\ln x - x + C$ Parts $u = \ln x$, $dv = dx$

   (g) $\int x\cos(\pi x)\, dx = \frac{x}{\pi}\sin \pi x + \frac{1}{\pi^2}\cos \pi x + C$ Parts $u = x$, $dv = \cos \pi x dx$

   (h) $\int 4y^2(9-3y^3)^5\, dy = -\frac{2}{27}(9-3y^3)^6 + C$ Sub $u = 9-3y^3$

   (i) $\int \frac{x^2}{\sqrt{1-x^2}}\, dx = \frac{1}{2}\sin^{-1} x - \frac{1}{2}x\sqrt{1-x^2} + C$

   Trig Sub $x = \sin\theta$

   (j) $\int \cos^5\theta \sin^2\theta\, d\theta = \frac{1}{3}\sin^3\theta - \frac{2}{5}\sin^5\theta + \frac{1}{7}\sin^7\theta + C$

   Trig Identity $cos^2\theta = 1 - sin^2\theta$, then sub $u = \sin\theta$

   (k) $\int x\sqrt{x^2-1}\, dx = \frac{1}{3}(x^2-1)^{3/2} + C$ Sub $u = x^2-1$