1. Evaluate the following integrals

   a. Let $u = 7x - 2$, $du = 7dx$. We find that
   $$\int 28(7x-2)^{-5}dx = \int 4u^{-5}du = 4\frac{u^{-4}}{-4} + c = -(7x-2)^{-4} + c.$$

   b. Let $u = 1 - r^3$, so $du = -3r^2dr$. It follows $u(0) = 1$ and $u(1) = 0$. We find that
   $$\int_0^1 \frac{9r^2dr}{\sqrt{1-r^3}} = -\int_1^0 3u^{-1/2}du = -6u^{3/2}\Big|_1^0 = 0 - (-6) = 6.$$

   c. Let $u = \sin(2\theta)$ so $du = 2\cos(2\theta)d\theta$ or $du/2 = \cos(2\theta)d\theta$. Then it follows
   $$\int \csc^2(2\theta)\cot(2\theta)d\theta = \frac{1}{2}\int u^{-2}du = \frac{1}{2}\cdot(-u^{-1}) + c = -\frac{1}{2\sin(2\theta)} + c.$$

   d. Let $u = z^2 - 1$ so $du = 2zdz$. We find that
   $$\int 8z(z^2-1)^{1/3}dz = \int 4u^{1/3}du = 3u^{4/3} + c = 3(z^2-1)^{4/3} + c.$$

   e. Let $u = 1 + v^{3/2}$ so $du = (3/2)\cdot v^{1/2}dv$. It follows $u(1) = 2$ and $u(4) = 8$. We find that
   $$\int_1^4 \frac{10\sqrt{v}}{(1+v^{3/2})^2}dv = \int_2^8 \frac{20}{3}u^{-2}du = -\frac{20}{3u}\Big|_2^8 = -\frac{20}{24} - (-\frac{20}{6}) = \frac{5}{2}.$$

   f. Let $u = \tan(a)$ so $du = \sec^2 a da$. We find that
   $$\int \tan^2(a)\sec^2(a)da = \int u^2du = \frac{u^3}{3} + c = \frac{\tan^3(a)}{3} + c.$$

   g. Let $u = \sin(\sqrt{x})$ so that $du = \cos(\sqrt{x})\cdot(1/2)x^{-1/2}dx$, so $2du = \cos(\sqrt{x})x^{-1/2}$. It follows that
   $$\int \frac{\cos(\sqrt{x})}{\sqrt{x}\sin^2(\sqrt{x})}dx = 2\int u^{-2}du = -2u^{-1} + c = -\frac{2}{\sin(\sqrt{x})} + c.$$

   h. In this case we choose $u = 1 - \sin(2t)$ so that $du = -2\cos(2t)dt$, and $u(0) = 1$ while $u(\pi/4) = 0$. We find that
   $$\int_0^{\pi/4}(1-\sin(2t))^{3/2}\cos(2t)dt = -\frac{1}{2}\int_1^0 u^{3/2}du = -\frac{1}{5}u^{5/2}\Big|_1^0 = 0 - (-\frac{1}{5}\cdot 1^{5/2}) = \frac{1}{5}.$$

2. First we find the general solution using indefinite integration. We need to evaluate
   $$s(t) = \int 6\sin(2t)dt.$$
   Letting $u = 2t$ we find $du = 2dt$, so
   $$\int 6\sin(2t)dt = \int 3\sin(u)du = 3\cos(u) + c = 3\cos(2t) + c.$$
   Using the initial condition we find
   $$0 = s(0) = 3\cos(0) + c = 3 + c.$$
   Thus, $c = -3$, so we find
   $$s(t) = 3\cos(2t) - 3.$$
   Evaluating this position function at $t = \pi/4$ we find
   $$s(\pi/4) = 3\cos(\pi/2) - 3 = 0 - 3 = -3.$$