1. Determine $\frac{d\vec{T}}{ds}$ by following the given steps if $\vec{r}(t) =< \cos t, 2\sin t >$:

   (a) Determine $\vec{r}\,'(t)$

   (b) Determine $||\vec{r}\,'(t)||$

   (c) Determine $\vec{T}$ and $\frac{d\vec{T}}{dt}$

   (d) Determine $\frac{d\vec{T}}{ds} = \left(\frac{dt}{ds}\right)\frac{d\vec{T}}{dt}$

2. Evaluate the follow integrals as convergent or divergent. If convergent, calculate its value.

   (a) $\int_0^\infty 7e^{-3x}\,dx$

   (b) $\int_5^\infty \frac{7\,dx}{(x-4)^2}$

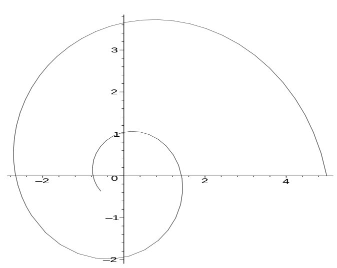
   (c) $\int_3^4 \frac{7\,dx}{(x-3)^2}$

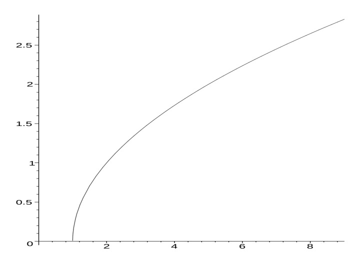
   (d) $\int_1^2 \frac{x}{\sqrt{x^2-1}}\,dx$

   (e) $\int_1^\infty \frac{3x}{5+4x^2}\,dx$

   (f) $\int_0^\infty \frac{3x}{1+4x^4}\,dx$

3. If the spiral $< 5e^{-0.5t}\cos t, 5e^{-0.5t}\sin t >$ goes on forever, what will be the arclength? (This is an improper integral). (picture below)





4. Determine the center of mass of the region with constant density and bounded by the x-axis, the line $x = 9$ and the function $f(x) = \sqrt{x-1}$. (picture above)

5. Determine the mass and the center of mass of a 0.7-m rod whose density varies linearly from 3.0 kg/m to 3.7 kg/m. (Note: First determine the linear function of density.)

6. Determine the Taylor Polynomial of the function $f(x) = e^x$ about $x = 0$.

   (a) Write $e = e^1$ as an infinite series.

   (b) Write $e^{-1} = \frac{1}{e}$ as an infinite series.

   (c) Write e^2 as an infinite series.

7. Determine the Taylor Polynomial of the function $f(x) = \ln x$ about $x = 1$.

   (a) Write $\ln 0.5$ as an infinite series.

   (b) Write $\ln 1.5$ as an infinite series.

8. Determine the Taylor Polynomial of the function $f(x) = \frac{1}{1-x}$ about $x = 0$.

   (a) From your answer, what is $\sum_{n=0}^{\infty} \left(\frac{2}{3}\right)^n$

   (b) From your answer, what is $\sum_{n=0}^{\infty} \left(-\frac{2}{3}\right)^n$

   (c) From your answer, what is $\sum_{n=0}^{\infty} \left(\frac{3}{5}\right)^n$

9. Integrate the following:

   (a) $\int 3xe^{-2x}\,dx$

   (b) $\int 3xe^{-2x^2}\,dx$

   (c) $\int 3x^3e^{2x^2}\,dx$

   (d) $\int \frac{x+2}{2x^2-3x+1}\,dx$

   (e) $\int_{-5}^{5} \sqrt{25-x^2}\,dx$

   (f) $\int \frac{3e^t}{\sqrt{4-e^t}}\,dt$