Calc 3: Assignment 11

1. Find velocity, acceleration, and speed, and draw
   these vectors for the specified value of t:
   a) \( \vec{v}(t) = \langle -12t^2, t \rangle \), \( t = 2 \)
   b) \( \vec{v}(t) = 3 \cos(t) \hat{i} + 2 \sin(t) \hat{j} \), \( t = \sqrt{3} \)
   c) \( \vec{v}(t) = \langle t, t^2, 2 \rangle \), \( t = 1 \)
   d) \( \vec{v}(t) = \langle e^t \cos(t), e^t \sin(t), te^t \rangle \), \( t = 0 \)

2. Find velocity and position if:
   a) \( \vec{a}(t) = \langle 1, 2, 3 \rangle \), \( \vec{v}(0) = \langle 0, 1, 0 \rangle \), \( \vec{r}(0) = \langle 0, 1, 0 \rangle \)
   b) \( \vec{a}(t) = \langle 2, \sin(t), \cos(t) \rangle \), \( \vec{v}(0) = \langle 0, \pi, 0 \rangle \), \( \vec{r}(0) = \langle 0, 0, 0 \rangle \)

3. If \( \vec{v}(t) = \langle t, t^2, 5t, t^2 - 16t \rangle \), when is the speed a minimum?

4. A projectile is fired at initial speed of 500 m/sec and angle of 30°. Find the range of projectile, the max. height, and the speed at impact.
5. Find the tangential and normal components of the acceleration:
   a) \( \frac{d}{dt} (t, t^2, t^3) \)
   b) \( \frac{d}{dt} (t, \cos(t), \sin(t)) \)
   c) \( \frac{d}{dt} (t, \cos(t), \sin^2(t)) \)

6. In the picture below the acceleration vector is shown. Estimate the tangential and normal components of \( \vec{a} \).

7. The position of a space ship is
   \[ \vec{r}(t) = (3t^2, 2t \ln(t), t - \frac{t}{t^2 + 1}) \]
   and the coordinates of a space station are \((6,4,9)\). Captain Bert wants to coast into the station. When should he turn the engines off?