Velocity and Acceleration Calculations

Linear Speed

v[d_,t_] is the function for determining linear speed
d is the distance traveled in a single frame in millimeters
t is the time per frame in seconds
Output units are m/s.

--> 60 frames per second yields t = 1/60 seconds

```
v[d_, t_] = (d / 1000) / t;
```

TO DO:

Enter your distance traveled for d1 and time for t1

```
d1 = 0;
t1 = 1 / 60;
v1 = v[d1, t1] // N
```

```
0.
```

If you are going to calculate linear acceleration, enter values for d2 and t2

d2 is the distance traveled in the next frame of the video and t2 is the time of that frame (probably just the same as t1

```
d2 = 12 / 11;
t2 = 1 / 60;
v2 = v[d2, t2] // N
```

```
0.0654545
```

Linear Acceleration

Using values from linear speed, we'll calculate the average linear acceleration

between the two consecutive frames. We'll assume that average speed for each frame was in the middle of each frame and so our Δt will just be the time of one frame. Output units are m/s^2.

```
linearA[vi_, vf_, Δt_] = (vf - vi) / Δt;
linearA[v1, v2, t1]
```

```
3.92727
```

Centripetal Acceleration

If we draw a smooth circle, we can calculate the acceleration of the particle using the following formula dependent upon radius "r" and period "τ". Output units are m/s^2.

```
centripetalA[r_, τ_] = 4 * Pi^2 * (r / 1000) / τ^2;
```

For you curious souls who wonder where this came from, recall that for centripetal acceleration:
a = v^2 / r
v = r * ω
ω = 2π / τ
a = (r * (2π / τ))^2 / r = r * 4π^2 / τ^2

TO DO:

Enter the radius of the circle in mm for r1 and the time in seconds taken to draw out the circle for τ1.

```
r1 = 168 / 55;
τ1 = 1 / 6;
centripetalA[r1, τ1] // N
```

```
4.34119
```