



# **Acceleration of the Follower Formulas**

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### **List of 19 Acceleration of the Follower Formulas**

### Acceleration of the Follower

1) Acceleration of Follower after Time t for Cycloidal Motion

$$\boxed{\mathbf{\hat{k}}} = \frac{2 \cdot \pi \cdot \omega^2 \cdot S}{\theta_o^2} \cdot \sin \left( \frac{2 \cdot \pi \cdot \theta_r}{\theta_o} \right)$$

Open Calculator 🗗

$$\boxed{ \textbf{ex} \left[ 18.83455 \text{m/s}^2 = \frac{2 \cdot \pi \cdot \left( 27 \text{rad/s} \right)^2 \cdot 20 \text{m}}{\left( 22 \text{rad} \right)^2} \cdot \sin \left( \frac{2 \cdot \pi \cdot 0.349 \text{rad}}{22 \text{rad}} \right) \right] }$$

2) Acceleration of Follower for Circular Arc Cam if there's Contact on Circular Flank

$$\mathbf{a} = \omega^2 \cdot (\mathbf{R} - \mathbf{r}_1) \cdot \cos(\theta_t)$$

Open Calculator

$$= 18.22429 ext{m/s}^2 = (27 ext{rad/s})^2 \cdot (4.955 ext{m} - 4.98 ext{m}) \cdot \cos(22.0 ext{rad})$$

3) Acceleration of Follower for Roller Follower Tangent Cam, there's Contact with Straight Flanks

$$\mathbf{x} = \omega^2 \cdot (\mathbf{r}_1 + \mathbf{r}_{\mathrm{rol}}) \cdot rac{\left(2 - \cos( heta)
ight)^2}{\left(\cos( heta)
ight)^3}$$

Open Calculator

4) Acceleration of Follower of Roller Follower Tangent Cam, there's Contact with Nose

$$\boxed{\mathbf{a} = \omega^2 \cdot \mathbf{r} \cdot \left(\cos(\theta_1) + \frac{\mathbf{L}^2 \cdot \mathbf{r} \cdot \cos(2 \cdot \theta_1) + \mathbf{r}^3 \cdot (\sin(\theta_1))^4}{\sqrt{\mathbf{L}^2 - \mathbf{r}^2 \cdot (\sin(\theta_1))^2}}\right)}$$

Open Calculator

$$9.3529 \text{m/s}^2 = \left(27 \text{rad/s}\right)^2 \cdot 0.012 \text{m} \cdot \left(\cos(6.5 \text{rad}) + \frac{(8.5 \text{m})^2 \cdot 0.012 \text{m} \cdot \cos(2 \cdot 6.5 \text{rad}) + (0.012 \text{m})^3 \cdot (\sin(6.5 \text{m})^2)}{\sqrt{(8.5 \text{m})^2 - (0.012 \text{m})^2 \cdot (\sin(6.5 \text{rad}))^2}}\right)$$



### 5) Centripetal Acceleration of Point P on Circumference

$$\mathbf{a}_{\mathrm{c}} = rac{\pi^2 \cdot \omega^2 \cdot \mathrm{S}}{2 \cdot heta_{\mathrm{o}}^2}$$

Open Calculator

ex 
$$148.6558 ext{m/s}^2 = rac{\pi^2 \cdot (27 ext{rad/s})^2 \cdot 20 ext{m}}{2 \cdot (22 ext{rad})^2}$$

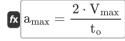
### 6) Centripetal Acceleration of Point P on Circumference when Follower Moves with SHM

$$a_c = rac{2 \cdot P_s^2}{S}$$

Open Calculator

$$ext{ex} \left[ 25.6 ext{m/s}^2 = rac{2 \cdot \left( 16 ext{m/s} 
ight)^2}{20 ext{m}} 
ight]$$

# 7) Max Acceleration of Follower during Outstroke if Outstroke Velocity is known Uniform Acceleration



Open Calculator

$$m ex \left[ 15.22481 m/s^2 = rac{2 \cdot 49.1 m/s}{6.45 s} 
ight]$$

### 8) Max Acceleration of Follower during Outstroke if Stroke of Follower is known Uniform Acceleration

$$\mathbf{a}_{max} = \frac{4 \cdot \omega \cdot S}{\theta_o \cdot t_o}$$

Open Calculator 🗗

## 9) Max Acceleration of Follower during Return Stroke if Follower Speed is known Uniform Acceleration

$$\mathbf{f}\mathbf{z} = rac{2 \cdot V_{ ext{max}}}{t_{ ext{R}}}$$

Open Calculator

$$oxed{ex} 21.82222 ext{m/s}^2 = rac{2 \cdot 49.1 ext{m/s}}{4.5 ext{s}}$$

### 10) Max Acceleration of Follower during Return Stroke if Follower Stroke is Known Uniform Acceleration

$$\mathbf{a}_{\mathrm{max}} = rac{4 \cdot \omega \cdot S}{ heta_{\mathrm{R}} \cdot t_{\mathrm{R}}}$$

Open Calculator 🚰



### 11) Maximum Acceleration of Follower during Outstroke for Cycloidal Motion

$$\mathbf{fx} = \frac{2 \cdot \pi \cdot \omega^2 \cdot S}{\theta_o^2}$$

Open Calculator

$$= \frac{2 \cdot \pi \cdot (27 \text{rad/s})^2 \cdot 20 \text{m}}{(22 \text{rad})^2}$$

### 12) Maximum Acceleration of Follower during Return Stroke for Cycloidal Motion

$$\mathbf{fx} = \frac{2 \cdot \pi \cdot \omega^2 \cdot S}{\theta_{\mathrm{R}}^2}$$

Open Calculator

ex 
$$15.25225 \text{m/s}^2 = \frac{2 \cdot \pi \cdot (27 \text{rad/s})^2 \cdot 20 \text{m}}{(77.5 \text{rad})^2}$$

### 13) Maximum Acceleration of Follower for Tangent Cam with Roller Follower

$$\mathbf{fx} \left[ \mathbf{a}_{\max} = \mathbf{\omega}^2 \cdot (\mathbf{r}_1 + \mathbf{r}_{\mathrm{rol}}) \cdot \left( rac{2 - (\cos(\phi))^2}{\left(\cos(\phi)
ight)^3} 
ight) 
ight]$$

Open Calculator

$$\boxed{\texttt{ex}} \left. 47728.36 \text{m/s}^{_2} = \left( 27 \text{rad/s} \right)^2 \cdot \left( 4.98 \text{m} + 31 \text{m} \right) \cdot \left( \frac{2 - \left( \cos(0.5 \text{rad}) \right)^2}{\left( \cos(0.5 \text{rad}) \right)^3} \right) \right|$$

### 14) Maximum Acceleration of Follower on Outstroke when Follower Moves with SHM

$$\mathbf{f}$$
  $\mathbf{a}_{ ext{max}} = rac{\pi^2 \cdot \omega^2 \cdot S}{2 \cdot heta_{ ext{o}}^2}$ 

Open Calculator

$$oxed{egin{align*} ext{ex} 148.6558 ext{m/s}^2 = rac{\pi^2 \cdot (27 ext{rad/s})^2 \cdot 20 ext{m}}{2 \cdot (22 ext{rad})^2} \end{split}}$$

### 15) Maximum Acceleration of Follower on Return Stroke when Follower Moves with SHM

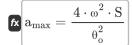
$$\mathbf{\hat{k}} \left[ \mathbf{a}_{max} = rac{\pi^2 \cdot \omega^2 \cdot S}{2 \cdot heta_R^2} 
ight]$$

Open Calculator

ex 
$$11.97909 \text{m/s}^2 = \frac{\pi^2 \cdot (27 \text{rad/s})^2 \cdot 20 \text{m}}{2 \cdot (77.5 \text{rad})^2}$$



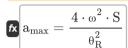
#### 16) Maximum Uniform Acceleration of Follower during Outstroke



Open Calculator

$$\boxed{ \textbf{ex} \ 120.4959 \text{m/s}^2 = \frac{4 \cdot (27 \text{rad/s})^2 \cdot 20 \text{m}}{\left(22 \text{rad}\right)^2} }$$

#### 17) Maximum Uniform Acceleration of Follower during Return Stroke



Open Calculator

### 18) Minimum Acceleration of Follower for Circular Arc Cam Contacting with Circular Flank

$$\mathbf{f}\mathbf{x} \left[ \mathbf{a} = \mathbf{\omega}^2 \cdot (\mathbf{R} - \mathbf{r}_1) \cdot \cos(\mathbf{\alpha}_2) 
ight]$$

Open Calculator

$$18.17346 ext{m/s}^2 = (27 ext{rad/s})^2 \cdot (4.955 ext{m} - 4.98 ext{m}) \cdot \cos(9.5 ext{rad})$$

#### 19) Minimum Acceleration of Follower for Tangent Cam with Roller Follower

$$\mathbf{x} = \omega^2 \cdot (\mathbf{r}_1 + \mathbf{r}_{\mathrm{rol}})$$

Open Calculator



#### Variables Used

- a Acceleration of Follower (Meter per Square Second)
- **a**<sub>c</sub> Centripetal Acceleration (Meter per Square Second)
- amax Maximum Acceleration (Meter per Square Second)
- L Distance b/w Roller Centre and Nose Centre (Meter)
- P<sub>s</sub> Peripheral Speed (Meter per Second)
- r Distance b/w Cam Center and Nose Center (Meter)
- R Radius of Circular Flank (Meter)
- r<sub>1</sub> Radius of the Base Circle (Meter)
- rrol Radius of Roller (Meter)
- S Stroke of Follower (Meter)
- to Time Required for the Outstroke (Second)
- t<sub>R</sub> Time Required for the Return Stroke (Second)
- V<sub>max</sub> Maximum Velocity of Follower (Meter per Second)
- α<sub>2</sub> Total Angle of Action of Cam (Radian)
- **0** Angle Turned by Cam from Beginning of Roller (Radian)
- $\theta_1$  Angle Turned by Cam When Roller is at Nose Top (Radian)
- $\theta_0$  Angular Displacement of Cam During Out Stroke (Radian)
- $\theta_r$  Angle Through Which Cam Rotates (Radian)
- $\theta_R$  Angular Displacement of Cam During Return Stroke (Radian)
- θ<sub>t</sub> Angle Turned by Cam (Radian)
- **Φ** Angle Turned by the Cam for Contact of Roller (Radian)
- ω Angular Velocity of Cam (Radian per Second)





### Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
   Archimedes' constant
- Function: cos, cos(Angle)
   Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: sin, sin(Angle)

  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Function: sqrt, sqrt(Number)

  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: Length in Meter (m)
  Length Unit Conversion
- Measurement: Time in Second (s)

  Time Unit Conversion
- Measurement: Speed in Meter per Second (m/s) Speed Unit Conversion
- Measurement: Acceleration in Meter per Square Second (m/s²)
   Acceleration Unit Conversion
- Measurement: Angle in Radian (rad)

  Angle Unit Conversion
- Measurement: Angular Velocity in Radian per Second (rad/s)

  Angular Velocity Unit Conversion





#### Check other formula lists

- Acceleration of the Follower Formulas
- Maximum Velocity of the Follower Formulas

Cam and Follower Formulas

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