Name _____

Linear Motion	Rotational Motion	Relation between them:
x (position, m):	θ (angle, rad)	$x = r\theta$
v (velocity, m/s): $v = \frac{\Delta x}{\Delta t}$,	ω (angular velocity, rad/s): $\omega = \frac{\Delta\theta}{\Delta t}$	$v = r\omega$
a (acceleration, m/s^2): $a = \frac{\Delta v}{\Delta t}$	α (angular acceleration, rad/s^2): $\alpha = \frac{\Delta\omega}{\Delta t}$	$a = r\alpha$
Linear Kinematics	**Rotational Kinematics**	
$x = x_0 + v_0 t + \frac{1}{2}at^2$	$\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$	
$v = v_0 + at$	$\omega = \omega_0 + \alpha t$	
$v^2 = v_0^2 + 2a(x - x_0)$	$\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$	

Signs: $\omega = +$ for counterclockwise, $\omega = -$ for clockwise

$\alpha = +$ for counterclockwise and speeding up, $\alpha = -$ for counterclockwise and slowing down,

$\alpha = -$ for clockwise and speeding up, $\alpha = +$ for clockwise and slowing down

1. A wheel accelerates from rest. After 8 seconds the wheel made 3 revolutions.

   (a) What is the angular acceleration of the wheel in rad/s^2?

   (b) What is the angular velocity in rad/s of the wheel after 8s?

2. A record on a record player starts from rest and begins rotating. The motor can accelerate the record at a rate of $1 rad/s^2$ and the manual says the record must be spinning at $33 rev/min$ before the music will play. How long will you have to wait until you hear the music?

   How many revolutions will the record have made at that time?

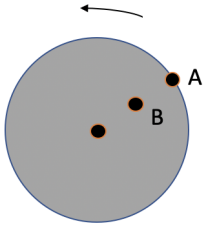
3. A car tire accelerates from rest to 30m/s in a time of 6s. The radius of each tire is 0.2m. (Assume the tires rotate counterclockwise, so that the angular speed is positive.)

   (a) What is the acceleration of the car?

   (b) What is the angular acceleration of each tire?

   (c) Now the driver slams on the brake and the car decelerates down to 20m/s in a time of 1s. What is the angular acceleration of each tire? (Is it positive or negative?)

4. Two points are on a disk rotating with a constant angular acceleration. The disk is speeding up. Point A is on the rim and Point B is halfway to the center of the disk. **A**:, **B**:, **C**: Same



   (a) Which point moves through a greater distance after a certain amount of time: x?

   (b) Which point turns through a greater angle, θ?

   (c) Which point has the greater linear (tangential) speed, v?

   (d) Which point has the greater angular speed, ω?

   (e) Which point has the greater linear (tangential) acceleration, a?

   (f) Which point has the greater angular acceleration, α?

   (g) Which point has the greater centripetal acceleration, $a_c = \omega^2 r$?

5. Now consider the case of a penny-farthing bike. **A**:, **B**:, **C**: Same

   (a) Which wheel moves through a greater distance after a certain amount of time: x?

   (b) Which wheel turns through a greater angle, θ?

   (c) Which wheel has the greater linear (tangential) speed, v?

   (d) Which wheel has the greater angular speed, ω?

   (e) Which wheel has the greater linear (tangential) acceleration, a?

   (f) Which wheel has the greater angular acceleration, α?

   (g) Which wheel has the greater centripetal acceleration, $a_c = \frac{v^2}{r}$?