Angular Kinematics Worksheets

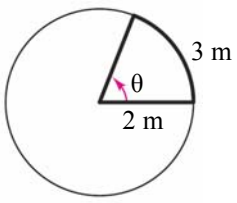
Radians

1. Express the following in angular measurement (radians):

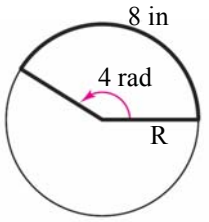
   a. 28°
   b. 50°
   c. 145°
   d. 3 rev
   e. 60 rev
   f. 0.25 rev/s
   g. 0.35 rev/s^2

   a. 0.49 rad
   b. 0.87 rad
   c. 2.5 rad
   d. 18.8 rad
   e. 377 rad
   f. 1.57 rad/s
   g. 2.18 rad/s^2

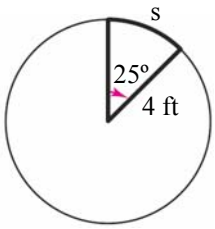
2. Find the unknowns:



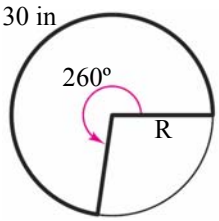
[1.5 rad]



[R = 2 in]



[s = 1.7 ft]



[R = 6.6 in]

3. Complete the following tables:

θ (rev)	θ (rad)	R (m)	s (m)
17		0.5	
	2	0.25	
		3	12
	10		45
8			20

ω (RPM)	ω (rad/s)	R (m)	v (m/s)
40		2	
	25	0.25	
		5	12
	15		40
22			8

4. A computer's hard drive spins at 7200 RPM. What is the angular velocity in rad/s? What is the velocity in m/s of the hard drive at a radius of 0.0889 m?

[754 rad/s]
[67 m/s]

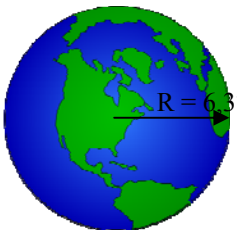
5. A record player has a velocity of 33.33 RPM. How fast is the record spinning in m/s at a distance of 0.085 m from the center?

[0.297 m/s]

6. A merry-go-round a.k.a "the spinny thing" is rotating at 15 RPM, and has a radius of 1.75 m
   A. How many revolutions will it make in 3 minutes?
   B. How many revolutions will it make in 10.0 seconds?
   C. How long does it take for a person to make 1 complete revolution?
   D. What is the velocity in m/s of person standing on its edge?

A. 45 rev
B. 2.5 rev
C. 4 s
D. 2.74 m/s

7. The Earth rotates 1 time every 24 hours…..
   A. How many RPM's is this?
   B. What is the velocity of a person standing on the surface of the Earth 6,378,000 m from the center?



A. 0.000694 RPM
B. 463 m/s

8. A typical circular saw has a radius of 0.184 m and rotates so the velocity of its edge is 110 m/s. How many RPM does the saw make?

[5710 RPM]

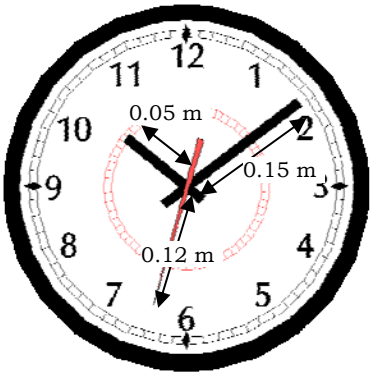
9. A centrifuge rotates so that 0.25 m from the center is traveling at 343 m/s (the speed of sound). How many RPM is this? What is its angular velocity?

[13,101 RPM]
[1372 rad/s]

10. What is the angular velocity (in rad/s and RPM) of the following:
    A. The hour hand of a clock.
    B. The minutes hand of a clock.
    C. The seconds hand of a clock.

A. 1.45×10^{-4} rad/s = 0.0014 RPM
B. 0.0017 rad/s = 0.017 RPM
C. 0.105 rad/s = 1 RPM

11. Calculate the linear speed of the tip of each hand on the following clock:



hr = 7.25×10^{-6} m/s
min = 2.55×10^{-4} m/s
sec = 0.0126 m/s

No angular acceleration

12. A wheel is spinning at 5 rad/s.
    a. How many radians will it turn through in 20 second?
    b. How many revolutions is this?

[a. 100 rad, b. 16 rev]

13. A fan spins through 600 radians in 10 seconds. What is its angular velocity?

[60 rad/s]

14. How long will it take for a helicopter blade to turn through 200 radians if its angular velocity is 60 rad/s?

[3.3 s]

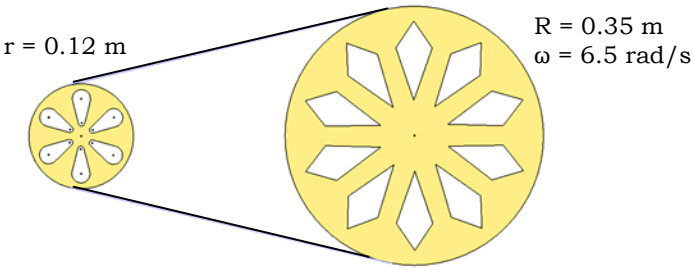
15. A baton twirler spins a baton at 25 RPM.
    a. What is its angular velocity in rad/s?
    b. How many rad will it travel in 4 seconds?

[a. 2.6 rad/s, b. 10.5 rad]

16. Which is greater 45 RPM or 4.71 rad/s?

[both are the same]

17. What is the ω of the smaller wheel if the angular velocity of the larger wheel is 6.5 rad/s? (Hint: same linear velocity).



[19 rad/s

Angular Acceleration.

18. A sharpening wheel is traveling at 5 rad/s, it slows down to rest in 30 seconds while sharpening an axe. What is its angular acceleration?

[-0.17 rad/s^2]

19. Staring from rest, an Apache helicopter's rotors undergo an angular acceleration of 0.75 rad/s^2.
    a. How fast will they be traveling in 60 seconds?
    b. How many radians have they rotated through?
    c. What is the linear velocity of the tip of the rotors (R = 7.3 m)?

[a. 45 rad/s, b. 1350 rad, c. 329 m/s]

20. A washing machine spin dries clothes. It starts spinning at 20 rad/s and slows down to 8 rad/s while turning through 500 revolutions.
    a. What is the angular acceleration?
    b. How much time does it take to slow down?

[a. 0.34 rad/s^2, 36 s]

21. A gyroscope rotates through and angle of 200 radians while accelerating from rest at 2.5 rad/s^2.
    a. How long does it take to reach 200 radians?
    b. What is it final angular velocity?
    c. What is the linear velocity at its edge (R = 0.05 m)?

[a. 12.6 s, b. 31.6 rad/s, c. 1.6 m/s]

22. A breeze causes a pinwheel (starting from rest). To accelerate at 0.4 rad/s^2 for 9 seconds.

    a. How many radians does it turn through?
    b. How many revolutions will it make?

[a. 16.2 rad, b. 2.57 rev]

23. How long will it take for a basketball spinning on someone's finger to stop if it undergoes and angular acceleration of -0.15 rad/s and is traveling at 27 rad/s initially? How many revolutions will it make?

[180 s, 387 rev]