EXERCISES 2-2

A particle moves with linear speed v and angular speed ω around a circle of radius r. Find the unknown quantity. Leave answers in terms of π.

A 1. $r = 6$ cm; $\omega = 8$ rad/s; $v =$? cm/s

2. $r = 10$ cm; $v = 15$ cm/s; $\omega =$? rad/s

3. $r = 2.0$ m; $v = 2.4$ m/s; $\omega =$? rad/min

4. $r = 3.6$ m; $\omega = 20$ rpm; $v =$? m/min

5. $r = 7.2$ cm; $\omega = 120°$/min; $v =$? cm/min

6. $r = 1.5$ m; $v = 900$ m/h; $\omega =$? rpm

7. $v = 200\pi$ ft/min; $\omega = 20$ rpm; $r =$? ft

8. $\omega = 270°$/s; $v = 30\pi$ cm/s; $r =$? cm

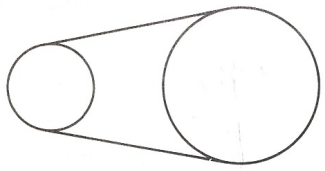
9. The linear speed of a point 10.8 cm from the center of a phonograph record is 12π cm/s. Find the angular speed of the phonograph record in revolutions per minute.

10. Find the linear speed to the nearest cm/s of a point 15 cm from the center of the record of Exercise 9.

11. A helicopter has just landed and its rotor is idling at 90 rpm. How fast, to the nearest m/s, are the tips of its 4.5-meter-long rotor blades moving?

12. A Ferris wheel 40 feet in diameter makes one revolution every two minutes. What is the speed of a seat on the rim of the wheel?

Exercises 13 and 14 refer to a fan belt joining a pulley 16 cm in diameter to one that is 9 cm in diameter. The smaller pulley is rotating at 4000 rpm.



13. Find the speed of a point of the fan belt.

14. How fast is the larger pulley rotating?

In Exercises 15-32, a particle starts at point M and travels for s cm or with angular speed ω counterclockwise around the circle $x^2 + y^2 = r^2$. Find the coordinates of the final position of the particle. Give exact answers if possible. Otherwise, give answers to three significant digits.

15. $M = (6, 0); r = 6; s = 4\pi$

16. $M = (8, 0); r = 8; s = 14\pi$

17. $M = (9, 0); r = 9; s = 48\pi$

18. $M = (12, 0); r = 12; s = 26\pi$

19. $M = (4, 0); r = 4; s = 3$

20. $M = (3, 0); r = 3; s = 4$

21. $M = (4, 0); r = 4; \omega = \frac{\pi}{6}$ rad/s; $t = 5$ s

22. $M = (6, 0); r = 6; \omega = \frac{4\pi}{30}$ rad/min; $t = 10$ min

23. $M = (10, 0); r = 10; \omega = 21°$/min; $t = 15$ min

24. $M = (15, 0); r = 15; \omega = 84°$/h; $t = 5$ h

25. $M = (7, 0); r = 7; \omega = 15$ rpm; $t = 45$ s

26. $M = (8, 0); r = 8; \omega = 35$ rpm; $t = 20$ s

B 27. $M = (0, -2); r = 2; \omega = \frac{5\pi}{18}$ rad/min; $t = 3$ min

28. $M = (-3, 3); r = 3\sqrt{2}; \omega = \frac{3\pi}{20}$ rad/s; $t = 5$ s

29. $M = \left(-2, 2\sqrt{3}\right); r = 4; \omega = 1000°$/h; $t = 45$ min

30. $M = \left(1, -\sqrt{3}\right); r = 2; \omega = 630°$/min; $t = 40$ s

31. $M = (-4, -4); r = 4\sqrt{2}; \omega = 3.4$ rpm; $t = 1$ min 15 s

32. $M = \left(3\sqrt{3}, 3\right); r = 6, \omega = 10$ rpm; $t = 50$ s

33. Find the linear speed (due to the rotation of Earth) of London, which has latitude 51°30′ N.

34. Find the linear speed of your school. Use a reasonable degree-minute estimation of latitude taken from an atlas.