Solve the problem.

1) Suppose that the radius r and the circumference $C = 2\pi r$ of a circle are differentiable functions of t.   1) _____
Write an equation that relates dC/dt to dr/dt.

2) If a and b are the lengths of the legs of a right triangle and c is the length of the hypotenuse,   2) _____
$c^2 = a^2 + b^2$. How is dc/dt related to da/dt and db/dt?

Provide an appropriate response.

3) If xy + x = 12 and dx/dt = -3, then what is dy/dt when x = 2 and y = 5?   3) _____

4) If $x^3 + y^3 = 9$ and dx/dt = -3, then what is dy/dt when x = 1 and y = 2?   4) _____

Solve the problem.

5) Water is falling on a surface, wetting a circular area that is expanding at a rate of 7 mm^2/s. How   5) _____
fast is the radius of the wetted area expanding when the radius is 194 mm?

6) A piece of land is shaped like a right triangle. Two people start at the right angle of the triangle at   6) _____
the same time, and walk at the same speed along different legs of the triangle. If the area formed
by the positions of the two people and their starting point (the right angle) is changing at 3 m^2/s,
then how fast are the people moving when they are 5 m from the right angle?

7) As the zoom lens in a camera moves in and out, the size of the rectangular image changes.   7) _____
Assume that the current image is 8 cm × 6 cm. Find the rate at which the area of the image is
changing (dA/df) if the length of the image is changing at 0.6 cm/s and the width of the image is
changing at 0.4 cm/s.

8) One airplane is approaching an airport from the north at 177 km/hr. A second airplane   8) _____
approaches from the east at 214 km/hr. Find the rate at which the distance between the planes
changes when the southbound plane is 28 km away from the airport and the westbound plane is
19 km from the airport.

9) A man 6 ft tall walks at a rate of 7 ft/sec away from a lamppost that is 14 ft high. At what rate is   9) _____
the length of his shadow changing when he is 60 ft away from the lamppost?

10) Boyle's law states that if the temperature of a gas remains constant, then PV = c, where   10) _____
P = pressure, V = volume, and c is a constant. Given a quantity of gas at constant temperature, if V
is decreasing at a rate of 10 in. ^{3}/sec, at what rate is P increasing when P = 20 lb/in.^{2} and V = 40
in.^{3}?

11) The volume of a sphere is increasing at a rate of 5 cm^3/sec. Find the rate of change of its surface   11) _____
area when its volume is $\dfrac{256\pi}{3}$ cm^3.

12) The radius of a right circular cylinder is increasing at the rate of 4 in./sec, while the height is   12) _____
decreasing at the rate of 6 in./sec. At what rate is the volume of the cylinder changing when the
radius is 11 in. and the height is 8 in.?

1) $\dfrac{dC}{dt} = 2\pi\dfrac{dr}{dt}$

2) $\dfrac{dc}{dt} = \dfrac{1}{c}\left(a\dfrac{da}{dt} + b\dfrac{db}{dt}\right)$

3) 9

4) $\dfrac{3}{4}$

5) 0.0057 mm/s

6) 0.60 m/s

7) 6.8 cm^2/sec

8) -267 km/hr

9) $\dfrac{21}{4}$ ft/sec

10) 5 lb/in.^{2} per sec

11) $\dfrac{5}{2}$ cm^2/sec

12) -22π in.^{3}/sec