Calculus

Chapter 4: Applications of Derivatives

Lesson 5: Related Rates

Question #1

Reference Q.564

Given that $W = 8D - 3$, if $\frac{dW}{dt} = 4$, what is $\frac{dD}{dt}$?

Question #2

Reference Q.565

The volume of a cylinder is given by $V = \pi r^2 h$ where h is the height and r the radius. Take the derivative with respect to time of this equation (i.e. your answer will have $\frac{dV}{dt}$, $\frac{dr}{dt}$, and $\frac{dh}{dt}$ in it).

Question #3

Reference Q.566

If $a = b^3 c^3$, and $\frac{db}{dt}\Big|_{t=1} = -2$, $\frac{dc}{dt}\Big|_{t=1} = 3$, what is $\frac{da}{dt}\Big|_{t=1}$ if $b = 1$ and $c = 2$ at $t = 1$?

Question #4

Reference Q.567

The spreading of oil according to a recent article indicated that oil spilled according to the formula: $R(t) = mt^n$ where $m = 5.24$, $n = 0.87$, $R(t)$ is the radius of the spread, and t is in seconds. From this data, what is the rate of increase in radius at $t = 42.30$?

Question #5

Reference Q.568

A huge beach ball is being deflated such that the radius is decreasing at a constant rate of $5\ \frac{cm}{s}$. How fast is the volume changing when the radius is 50 cm?

Question #6

Reference Q.569

A 5.0 m ladder is leaning against a wall. If the base of the ladder moves away from the wall at a rate of 1.0 m/s, how fast does the top of the ladder move down from the wall when the base is 4.0 m away from the wall?

Question #7

Reference Q.571

Sawdust is falling at a rate of $16.0\ \frac{m^3}{min}$ from a conveyor belt into a pile of sawdust that is shaped like a cone. The cone has a base radius of $5.0\ m$ and a height of $12.0\ m$. How fast is the height of the sawdust rising when it is 9.6 m high?

Question #8

Reference Q.10734

A 6 ft person is walking away from a lamppost that is 10 ft high. If the person walks at a constant rate, and the person's shadow is lengthening at a rate of 2 ft / sec, at what rate is the person walking?

Question #9

Reference Q.572

A projectile is shot out of a cannon at $30°$ to the horizontal. If its speed is 800 km/h, and we ignore air friction, how fast is it climbing vertically?

Question #10

Reference Q.574

A particle in the x-y plane is moving in such a way that $\frac{dx}{dt} = -2\ m/sec$ and $\frac{dy}{dt} = 3\ m/sec$. How fast is its distance from the origin changing when it passes through the point $(-4, 5)$?

Question #11

Reference Q.50176

A particle moves along the curve $x^2 = \frac{x}{y} + 6$. At a certain moment in time, $x = 3$ and $\frac{dx}{dt} = -2$. At that exact moment, what is $\frac{dy}{dt}$?

Question #12

Reference Q.50179

While Pavel is enjoying watching a hot air balloon rise steadily into the sky, he unknowingly begins to walk towards the launch pad at a pace of 0.4 ft/s. At the moment he is 80 ft away from the launch pad, the rate of change of the angle of Pavel's eye gaze is 0.3 degrees per second. If the balloon is 100 ft in the air at this moment, how fast is the balloon rising?

Question #13

Reference Q.9211

The sides of a square are growing at a rate of 2 cm/s. How fast is the diagonal growing?

Question #14

Reference Q.9212

Belle is standing at the top of a 5 m ladder, trying to paint a wall; the ladder, however, is very gracefully slipping. The angle made between the ladder and the floor, originally $\frac{3\pi}{8}$ is decreasing at $\frac{\pi}{32}$ radians per second - how fast is she falling when she's already halfway between her starting point and the floor?

Question #15

Reference Q.9213

A favourite traditional aboriginal dessert is bannock. One night, Azaadi was dreaming of a berry-bannock pudding, poured into a cone-shaped dish. But the conical dish and and the pudding kept growing wider indefinitely; the height stayed fixed at 50 cm, but the radius gew at 0.5 cm/s. How fast is the amount of berry-bannock pudding growing (how fast is the volume of the conical dish growing) when the radius equals the height?!

Question #16

Reference Q.9214

If the area of a circle is increasing 4 times as fast as its radius, how big is the radius?