Discussion_13

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To Do

Using R, provide the solution for any exercise in either Chapter 4 or Chapter 7 of the calculus textbook. If you are unsure of your solution, post your concerns.

Section 4.2: Exercise 9

A 24 ft. ladder is leaning against a house while the base is pulled away at a constant rate of 1 ft/s.

At what rate is the top of the ladder sliding down the side of the house when the base is:

- A: 1 foot from the house?
- B: 10 feet from the house?
- C: 23 feet from the house?
- D: 24 feet from the house?

Goal

To find the rate of change of two or more variables that are changing with respect to time.

How?

take the Derivative Implicitly and every variable gets multiplied by $\frac{d}{dt}$ (derivative with respect to time)

Link Equation to Data

Pythagorean theorem

$x^2 + y^2 = 24^2$

Derivative

Pulled Away = Positive $\frac{d}{dt} = 1$ ft/s

Derivative with respect to time

$\frac{d}{dt}(x^2) + \frac{d}{dt}(y^2) = \frac{d}{dt}(24^2)$

$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$

$x\frac{dx}{dt} + y\frac{dy}{dt} = 0$

$\frac{dy}{dt} = -\frac{x}{y}\frac{dx}{dt}$

Solve Pythagorean theorem

getting the value of a

```
a = sqrt(24^2 - 1^2)
a
```

```
## [1] 23.97916
```

```
db_dt <- 1
```

Finding the Derivative of rate of change

```
da_dt <- -1/a
da_dt
```

A: 1 foot from the house?

```
## [1] -0.04170288
```

Result: -0.0417029 ft/s

```
b <- 10
a_2 <- sqrt(24^2 - b^2)

da_dt_2 <- (-b * db_dt) / a_2
```

B: 10 feet from the house? Result: -0.4583492 ft/s

```
c <- 23
a_3 <- sqrt(24^2 - c^2)
da_dt_3 <- (-c * db_dt) / a_3
```

C: 23 feet from the house? Result: -3.3548948 ft/s

```
d <- 24
a_4 <- sqrt(24^2 - d^2)
da_dt_4 <- (-c * db_dt) / a_4
```

D: 24 feet from the house? Result: $-\infty$ ft/s