

Related Rates Examples

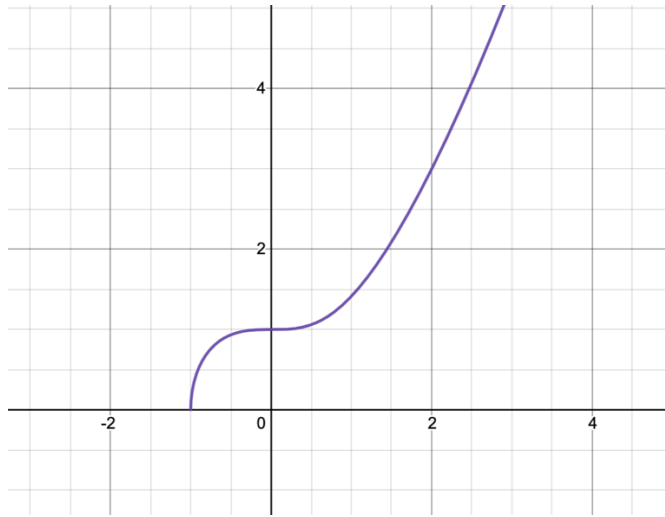
Example 1

$$x^2 + y^2 = 25 \text{ and } \frac{dy}{dt} = 6 \text{ and } y = 4 \text{ with } x > 0$$

Determine $\frac{dx}{dt}$

Example 2

A particle moves along the curve $y = \sqrt{1 + x^3}$



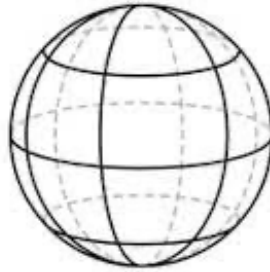
As it reaches the point $(2,3)$ the y -coordinate is decreasing at a rate of 4 cm/sec. How fast is the x coordinate changing when the particle reaches the location $(2,3)$?

Example 3

A snowball melts so that the surface area decreases at a rate of $2 \text{ cm}^2/\text{min}$.

$$S = 4\pi r^2$$

Sphere



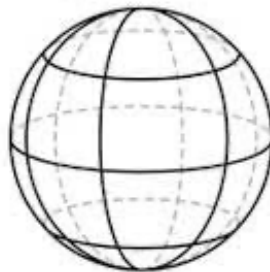
Find the rate at which the radius decreases when the radius measures 4 cm .

Example 4

A snowball melts so that the surface area decreases at a rate of $1 \text{ cm}^2/\text{min}$.

$$S = 4\pi r^2$$

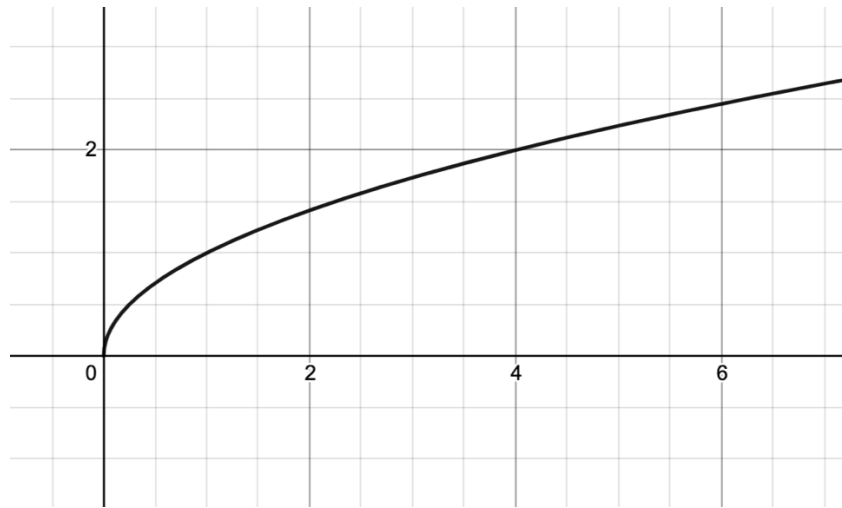
Sphere



Find the rate at which the diameter decreases when the diameter measures 10 cm .

Example 5

A particle moves along a curve $y = \sqrt{x}$



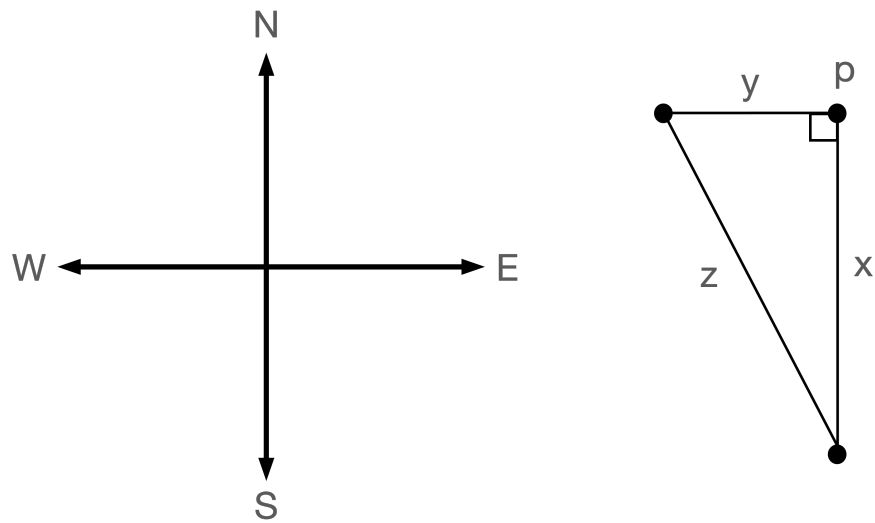
As the particle passes through the point $(4,2)$ the x-coordiante increases at a rate of 3 cm/sec .

How fast is the distance between the particle and the origin changing at this instant?

Example 6

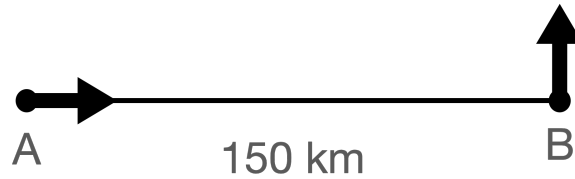
Two cars start moving from the same point P. One car travels South at a rate of 60 mph and the other car travels West at a rate of 25 mph. At what rate is the distance between the two cars increasing 2 hours later?

Hint: Draw a picture of the question and determine the related rates equation for the Geometry of the situation. Identify the known variables and the unknown variables.

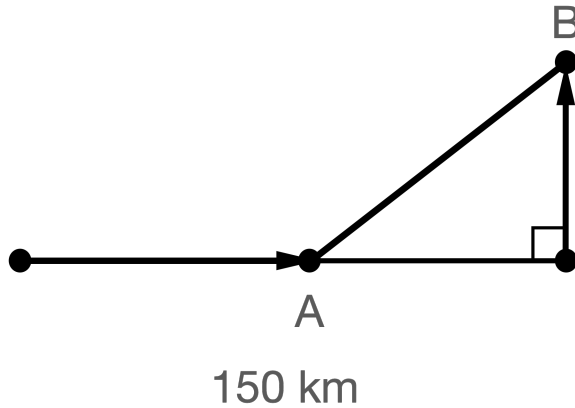


Example 7

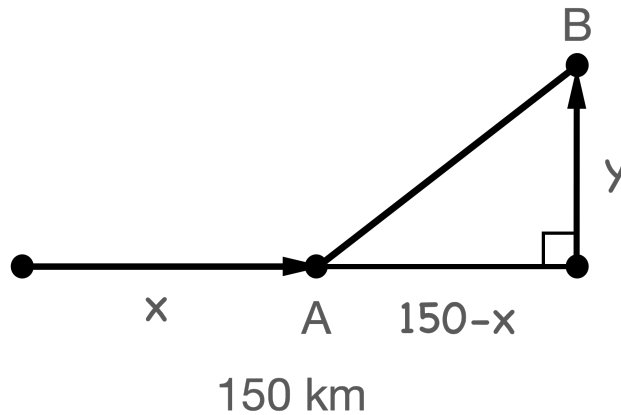
At **noon** ship A is 150 KM West of Ship B. Ship A is sailing East at 35 km/h and ship B is sailing North at 25 km/h.

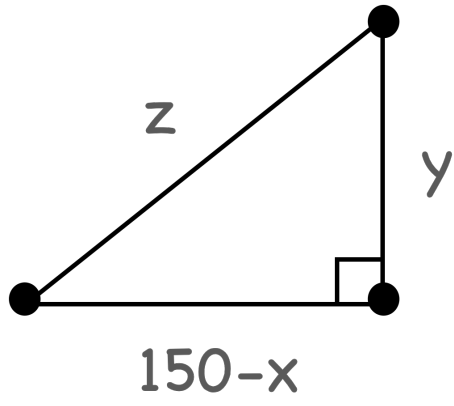


How fast is the distance between the two ships changing at **4:00 PM**, which is 4 hours later?



Hint: Draw a picture of the question and determine the related rates equation for the Geometry of the situation. Identify the known variables and the unknown variables.

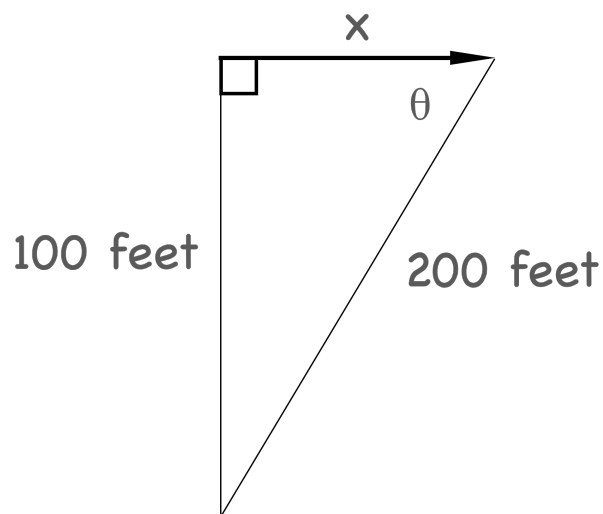
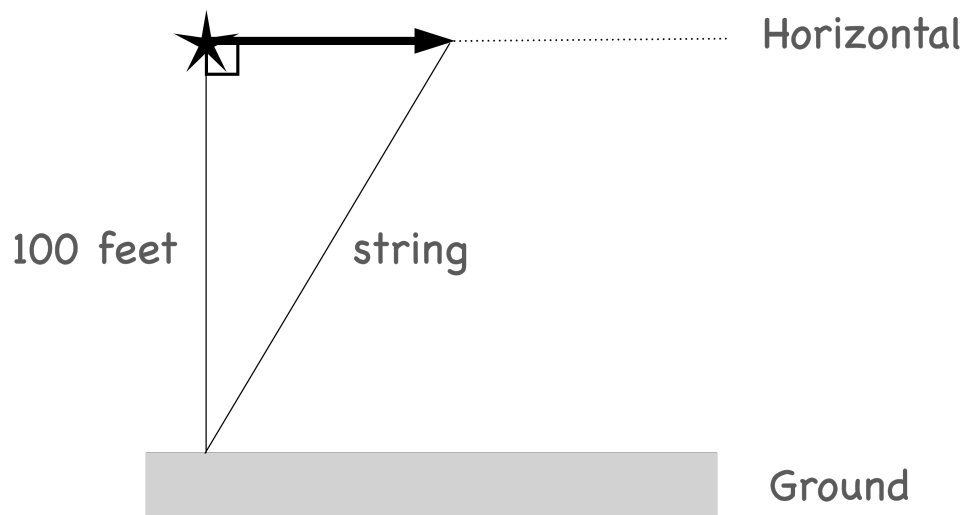




Example 8

A kite is 100 feet above the ground and is moving horizontally at a speed of 8 feet/sec . At what rate is the angle between the string and the horizontal decreasing when 200 feet of string has been let out?

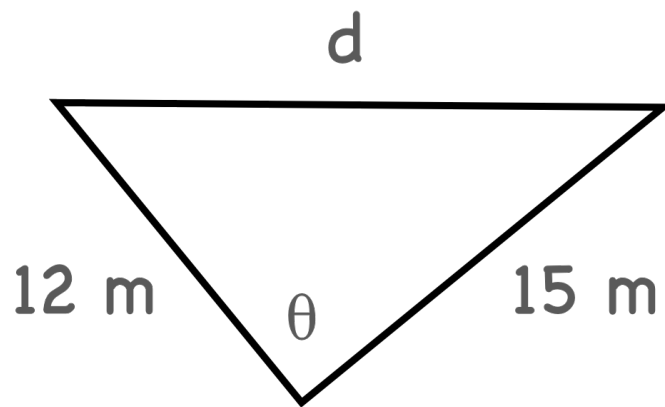
Hint: Draw a picture of the question and determine the related rates equation for the Geometry of the situation. Identify the known variables and the unknown variables.



Example 9

Two sides of a triangle are 12m and 15m in length and the angle between them is increasing at a rate of 2° per min. How fast is the length of the third side increasing when the angle between the sides reaches 60° .

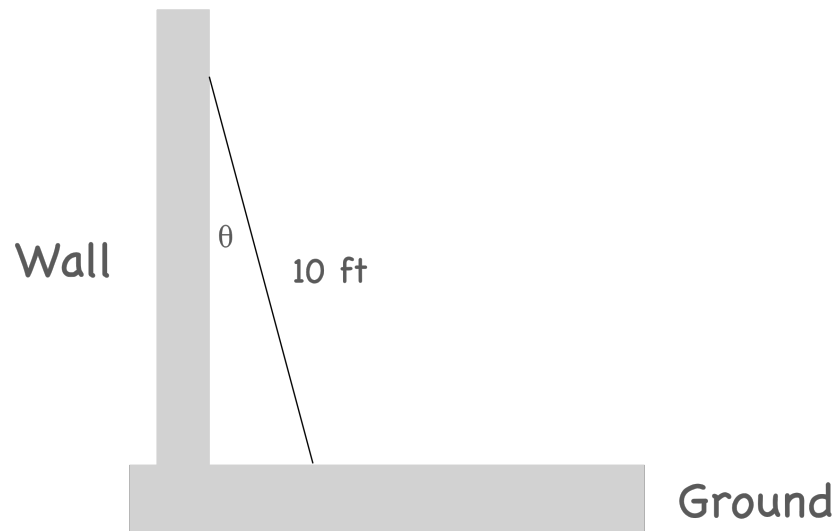
Hint: Draw a picture of the question and determine the related rates equation for the Geometry of the situation. Identify the known variables and the unknown variables.

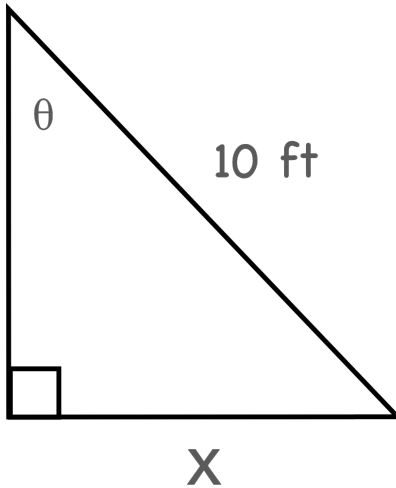


Example 10

A ladder 10 ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a speed of 2 *feet per sec*, how fast is the angle between the top of the ladder and the wall changing when the angle reaches $\pi/4$ radians?

Hint: Draw a picture of the question and determine the related rates equation for the Geometry of the situation. Identify the known variables and the unknown variables.





Example 11

Two cars start at the same location at the same time. One car travels $N50^\circ W$ at a rate of 50 mph while a second car travels $N25^\circ E$ at a rate of 70 mph. What is the rate of the increasing distance between the two cars after 3 hours have passed?

Hint: Draw a picture of the question and determine the related rates equation for the Geometry of the situation. Identify the known variables and the unknown variables.

