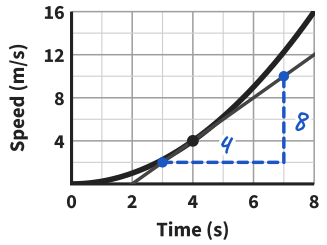
The gradient of a curve

ANSWERS

1

Find the acceleration at 4 seconds.



change up = 8

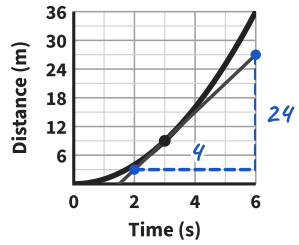
change across = 4

rate = $\frac{8}{4}$

Acceleration 2 m/s²

2

Find the speed at 3 seconds.



change up = 24

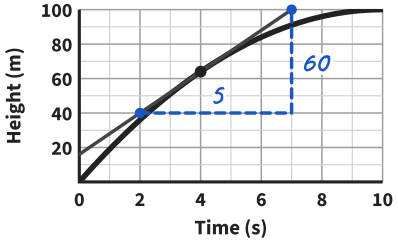
change across = 4

rate = $\frac{24}{4}$

Speed 6 m/s

3

Draw a big triangle on the tangent.
Find how fast the ball is rising at 4 seconds.



change up = 60

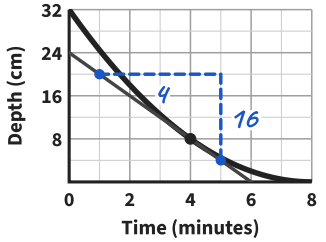
change across = 5

rate = $\frac{60}{5}$

Speed 12 m/s

4

Water drains from a sink. Find how fast the depth is falling at 4 minutes.



change up = −16

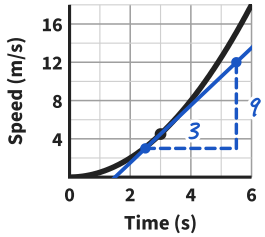
change across = 4

rate = $\frac{-16}{4}$

Falling at 4 cm per minute

5

Draw a tangent at 3 seconds.
Estimate the acceleration at 3 seconds.

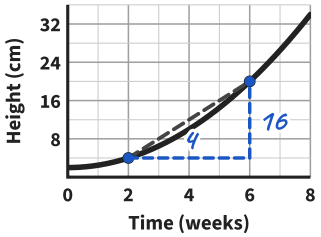


9 ÷ 3 = 3 (accept 2.5 to 3.5)

Acceleration about 3 m/s²

6

A sunflower grows. Use the dashed chord to find its average rate of growth between 2 and 6 weeks.

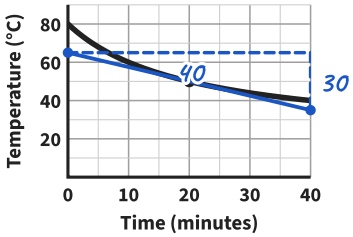


(20 − 4) ÷ (6 − 2) = 16 ÷ 4

Average rate 4 cm per week

7

Soup cools in a bowl. Draw a tangent at 20 minutes. Estimate how fast it is cooling then.

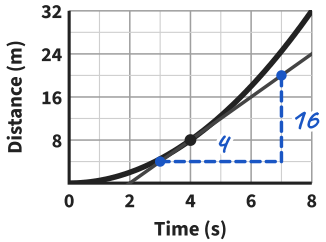


30 ÷ 40 = 0.75 (accept 0.5 to 1)

Cooling at about 0.75 °C per minute

8

Ravi wants the speed at 4 s. He works out 8 ÷ 4 = 2 m/s. Explain his mistake, then find the speed.



8 ÷ 4 is a chord from (0, 0): the average tangent: 16 ÷ 4 = 4

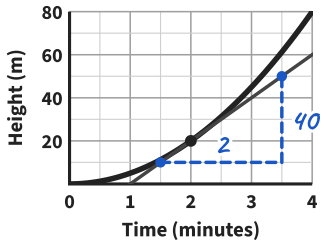
Speed 4 m/s

The gradient of a curve *further practice*

ANSWERS

9

A balloon rises. The tangent at 2 minutes is drawn. Find how fast the balloon is rising then.

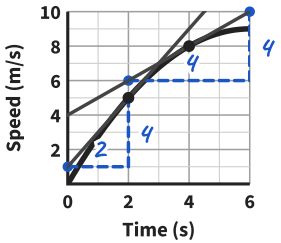


40 ÷ 2 = 20

Rate 20 m per minute

10

A sprinter's speed, with tangents at 2 s and 4 s. How many times greater is her acceleration at 2 s than at 4 s?

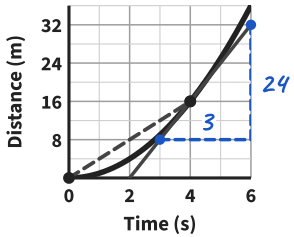


2 s: 4 ÷ 2 = 2 m/s², 4 s: 4 ÷ 4 = 1 m/s²

Answer 2 times

11

A car starts from rest. Find its average speed over the first 4 s (the chord) and its speed at 4 s (the tangent).

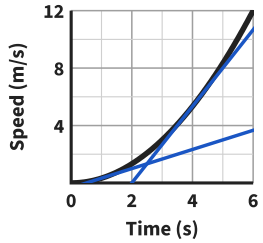


16 ÷ 4 = 4, 24 ÷ 3 = 8

Answer 4 m/s and 8 m/s

12

A van's speed is shown.
Is its acceleration getting bigger or smaller? Explain how you know.

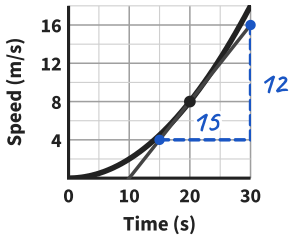


the curve gets steeper, so the tangents get steeper

Reason bigger

13

The tangent at 20 s is drawn. Find the acceleration at 20 s. Watch the scales.

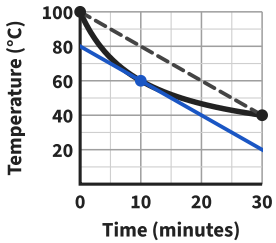


12 ÷ 15 = 0.8

Answer 0.8 m/s²

14

An oven cools. Use the chord to find the average rate it cools over 30 minutes. Estimate when it is cooling at exactly this rate.

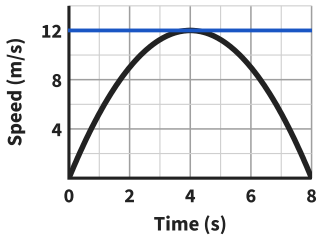


60 ÷ 30 = 2, the tangent parallel to the chord

Answer 2 °C per minute, at about 10 min

15

A lift's speed is shown. At what time is its acceleration zero? What is its speed then?

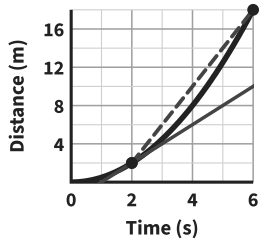


the tangent is flat at the top

Answer 4 s, 12 m/s

16

The tangent at 2 s and the chord from 2 s to 6 s are drawn. Which gives the greater speed? Explain, then check.



the curve gets steeper after 2 s

chord 16 ÷ 4 = 4, tangent 2 m/s

Answer the chord