

AP Calculus AB - Rates of Change in Context and Straight-Line Motion - Worksheet

Common Core AP CALC AB 4.1, AP CALC AB 4.2, AP CALC AB 4.3 · maths-pdf.fr/en/

Name: _____ Class: _____ Date: ____/____/____

These 21 problems practice interpreting derivatives in context, and straight-line motion with position, velocity, acceleration and speed (AP Calculus AB, topics 4.1, 4.2, 4.3). The early problems build the basic skill, and each one uses a different function or situation so that no two feel alike.

Later problems use sign charts, velocity graphs, tables of values, total distance and real situations such as a draining tank and bacteria growth. Work in pencil, show every step, and check the answer key only after a full attempt.

AP Calculus AB · Common Core State Standards: **AP CALC AB 4.1, AP CALC AB 4.2, AP CALC AB 4.3**

Exercise 1 - Interpreting a cost derivative

The cost in dollars of printing x flyers is $C(x)$, and $C'(500) = 0.12$. Interpret this value.

Exercise 2 - Interpreting a temperature derivative

A greenhouse temperature in °F is $T(t)$ after t hours, and $T'(3) = -4.5$. Interpret this value.

Exercise 3 - Velocity and direction

A bicycle's position in meters along a path is $s(t) = t^2 - 6t + 5$ for $t \geq 0$ seconds. Find $v(t)$, when it is at rest, and when it moves left or right.

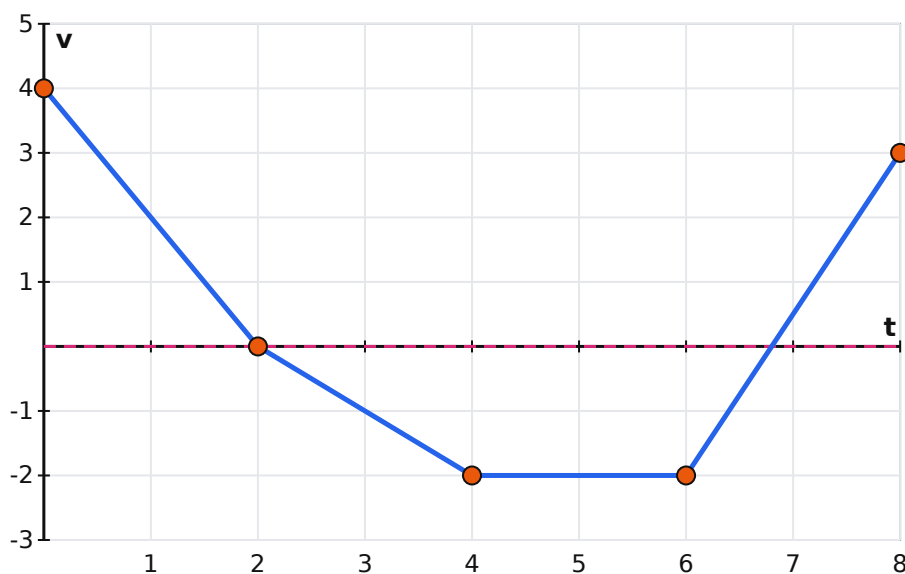
Exercise 4 - Velocity and acceleration

A drone's height in feet is $s(t) = t^3 - 6t^2 + 5t$. Find $v(2)$ and $a(2)$ with units.

Exercise 5 - Speeding up or slowing down

A particle moves with $s(t) = 2t^3 - 9t^2 + 12t$. Decide whether it is speeding up or slowing down at $t = 0.5$, $t = 1.5$ and $t = 3$.

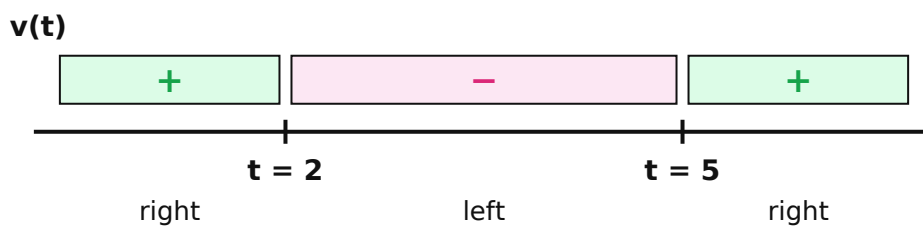
Exercise 6 - Reading a velocity graph



Velocity of a particle in feet per second.

The graph shows the velocity $v(t)$ of a particle. (a) When is the particle at rest? (b) On which interval is it moving left? (c) When is the speed greatest on $[0, 8]$? (d) Find the acceleration on $0 < t < 2$.

Exercise 7 - Sign chart for direction



Sign chart for velocity.

A particle has velocity $v(t) = (t-2)(t-5)$ for $t \geq 0$. Describe its direction of motion.

Exercise 8 - Average versus instantaneous velocity

A runner's position is $s(t) = t^2 + 2t$ meters. Find the average velocity on $[1, 3]$ and the instantaneous velocity at $t = 1$ and $t = 3$.

Exercise 9 - Estimating velocity from a table

t (s)	0	1	2	3	4
s (ft)	0	5	18	39	68

Position of a go-kart.

Use the table to estimate the velocity at $t=2$ with the average velocity over $[1,3]$, and give the units.

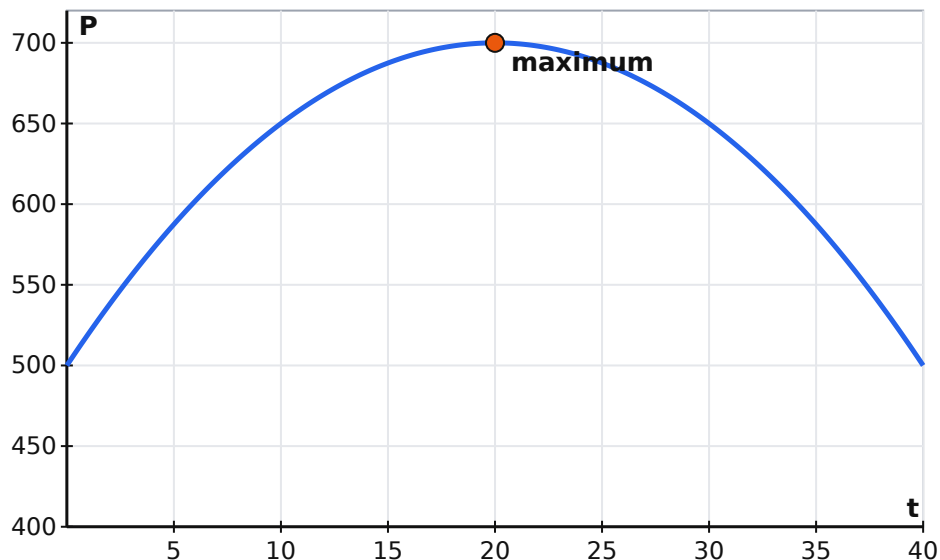
Exercise 10 - Area of a circle

A circular oil spill has area $A(r) = \pi r^2$ square feet when the radius is r feet. Find $A'(5)$ and interpret it.

Exercise 11 - Volume of a cube

The volume of a cube with side s inches is $V(s) = s^3$. Find the rate of change of volume with respect to s at $s=4$.

Exercise 12 - Population growth



Population of a town.

A town's population is $P(t) = 500 + 20t - 0.5t^2$ people after t years. Find $P'(10)$ and $P'(20)$ and interpret them.

Exercise 13 - Marginal revenue

The revenue in dollars from selling x skateboards is $R(x) = 120x - 0.4x^2$. Find $R'(50)$ and

interpret it.

Exercise 14 - Oscillating spring

A spring's position in centimeters is $s(t) = 3\sin t$. Find the velocity and acceleration at $t = \frac{\pi}{3}$.

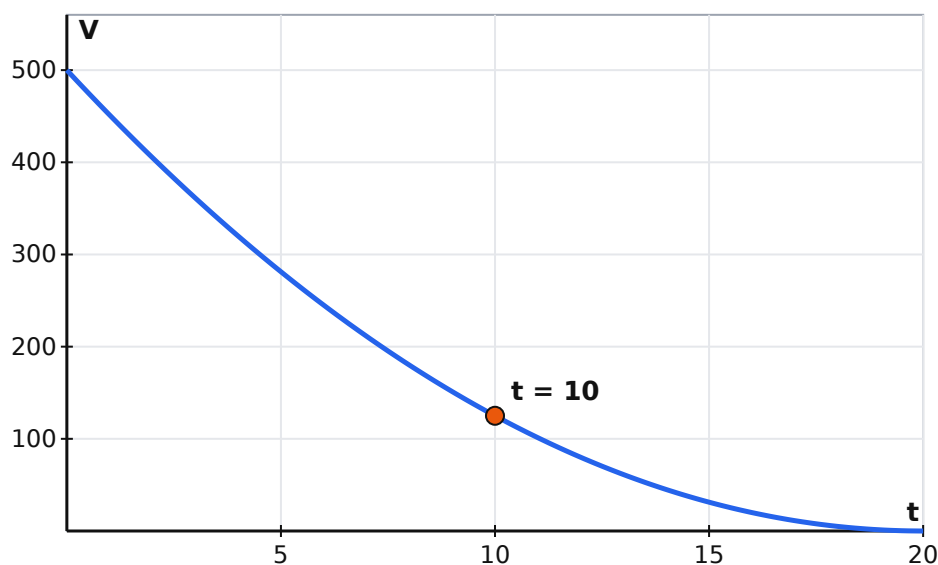
Exercise 15 - Bacteria growth

A culture has $N(t) = 200e^{0.3t}$ bacteria after t hours. Find $N'(5)$ and interpret it.

Exercise 16 - Total distance

A hiker's position along a trail in feet is $s(t) = 2t^3 - 15t^2 + 24t$ after t minutes. Find the total distance traveled from $t = 0$ to $t = 5$ minutes.

Exercise 17 - Draining tank



Gallons left in the tank.

Water drains from a tank so that the volume in gallons is $V(t) = 500\left(1 - \frac{t}{20}\right)^2$ after t minutes. Find $V'(10)$ and interpret it.

Exercise 18 - Pauses and speeding up

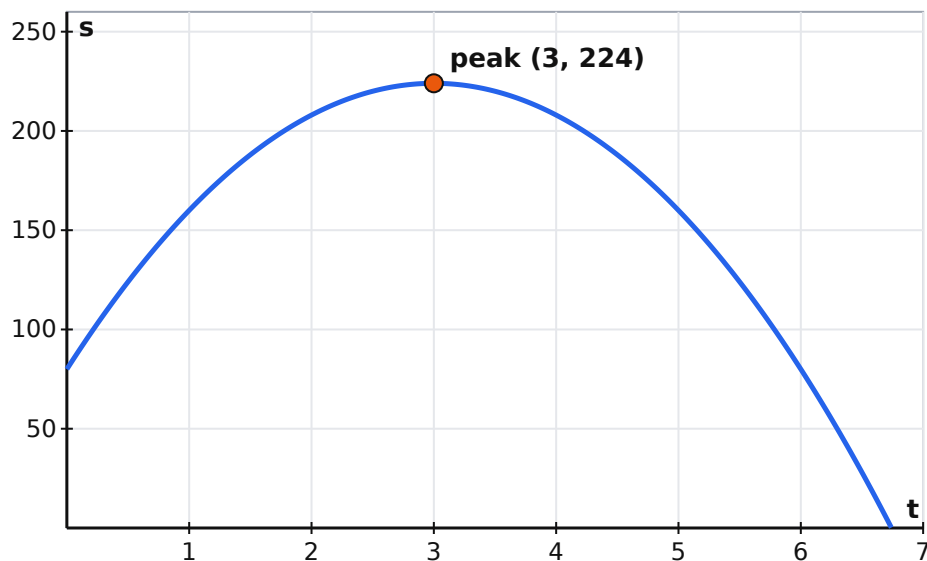
A particle has $s(t) = t^4 - 8t^3 + 18t^2$ for $t \geq 0$. Find when it is at rest, whether it ever changes direction, and when its speed is increasing.

Exercise 19 - Displacement versus distance

A cart has position $s(t) = t^3 - 3t^2$ meters. Find its displacement and its total distance traveled

from $t=0$ to $t=3$ seconds.

Exercise 20 - Model rocket



Height of a model rocket in feet.

Noah launches a model rocket from a platform. Its height in feet is $s(t) = -16t^2 + 96t + 80$ after t seconds. Find the velocity function, the maximum height, and the velocity when it hits the ground.

Exercise 21 - Estimating a rate from a table

t (months)	0	1	2	3	4
thousand dollars	0	8	22	44	76

Cumulative sales of a new product.

The table shows cumulative sales $S(t)$ in thousands of dollars. Estimate $S'(2)$ using the interval $[1,3]$ and interpret the result with units.