

## Derivatives from a table

### 2015 BC3

1. Johanna jogs along a straight path. For  $0 \leq t \leq 40$ . Johanna's velocity is given by a differentiable function  $v$ . Selected values of  $v(t)$ , where  $t$  is measured in minutes and  $v(t)$  is measured in meters per minute, are given in the table.

$t$ (minutes)	0	12	20	24	40
$v(t)$ (meters per minute)	0	200	240	-220	150

- a) Use the data in the table to estimate the value of  $v'(16)$ .

### 2014 BC 4

$t$ (minutes)	0	2	5	8	12
$v_A(t)$ (meters/min)	0	100	40	-120	-150

4. Train A runs back and forth on an east-west section of railroad track. Train A's velocity, measured in meters per minute, is given by a differentiable function  $v_A(t)$ , where time  $t$  is measured in minutes. Selected values for  $v_A(t)$  are given in the table above.
- a) Find the average acceleration of train A over the interval  $2 \leq t \leq 8$ .

2013 BC3

Hot water is dripping through a coffeemaker, filling a large cup with coffee. The amount of coffee in the cup at time  $t$ ,  $0 \leq t \leq 6$ , is given by a differentiable function  $C$ , where  $t$  is measured in minutes. Selected values of  $C(t)$ , measured in ounces, are given in the table.

t(minutes)	0	1	2	3	4	5	6
C(t) ounces	0	5.3	8.8	11.2	12.8	13.8	14.5

- a) Use the data in the table to approximate  $C'(3.5)$ . Show the computations that lead to your answer, and indicate units of measure.

2011 #2

t(minutes)	0	2	5	9	10
H(t) degrees C	66	60	52	44	43

As a pot of tea cools, the temperature of the tea is modeled by a differentiable function  $H$  for  $0 \leq t \leq 10$  where time  $t$  is measured in minutes and temperature  $H(t)$  is measured in degrees Celsius. Values of  $H(t)$  at selected values of time  $t$  are shown in the table above

Use the data in the table to approximate the rate at which the temperature of the tea is changing at time  $t = 3.5$ . Show the computations that lead to your answer.

2012 #4

The function  $f$  is twice differentiable for  $x > 0$  with  $f(1) = 15$  and  $f''(1) = 20$ . Values  $f'$ , the derivative of  $f$ , are given for selected values of  $x$  in the table.

$x$	1	1.1	1.2	1.3	1.4
$f'(x)$	8	10	12	13	14.5

- a) Write an equation for the line tangent to the graph of  $f$  at  $x = 1$ . Use this line to approximate  $f(1.4)$ .

2012 #1

t(minutes)	0	4	9	15	20
W(t) degrees F	55.0	57.1	61.8	67.9	71.0

The temperature of water in a tub at time  $t$  is modeled by a strictly increasing, twice differentiable function,  $W$ , where  $W(t)$  is measured in degrees Fahrenheit and  $t$  is measured in minutes. At time  $t = 0$ , the temperature of the water is  $55^\circ$  F. The water is heated for 30 minutes, beginning at time  $t = 0$ . Values of  $W(t)$  at selected times  $t$  for the first 20 minutes are given in the table above.

- a) Use the data in the table to estimate  $W'(12)$ . Show the computations that lead to your answer. Using correct units, interpret the meaning of your answer in the context of this problem.

2010 #2

A zoo sponsored a one-day contest to name a new baby elephant. Zoo visitors deposited entries in a special box between noon ( $t=0$ ) and 8 P.M. ( $t=8$ ). The number of entries in the box  $t$  hours after noon is modeled by a differentiable function  $E$  for  $0 \leq t \leq 8$ . Values of  $E(t)$ , in hundreds of entries, at various times  $t$  are shown in the table.

t(hours)	0	2	5	7	8
E(t) (hundreds of entries)	0	4	13	21	23

- b) Use the data in the table to approximate the rate in hundreds of entries per hour, at which entries were being deposited at time  $t = 6$ . Show the computations that lead to your answer.

2009 #5

Let  $f$  be a function that is twice differentiable for all real numbers. The table gives values of  $f$  for selected points in the closed interval  $2 \leq x \leq 13$ .

x	2	3	5	8	13
f(x)	1	4	-2	3	6

Estimate  $f'(4)$ . Show the work that leads to your answer.