

BC #1

29. The path of a satellite is given by the parametric equations

$$x = 4 \cos t + \cos 12t.$$

$$y = 4 \sin t + \sin 12t.$$

The upward velocity at $t = 1$ equals

- (A) 2.829 (B) 3.005 (C) 3.073 (D) 3.999 (E) 12.287

*we know velocity = derivative = slope

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\text{upward change}}{\text{left + right change}}$$

since we just want the upward change, we only need to look at dy

$$y = 4 \sin t + \sin 12t$$

$$dy = 4 \cos t + \cos(12t) \cdot 12$$

plug in $t = 1$

$$dy = 4 \cos(1) + \cos(12) \cdot 12 \quad \leftarrow \text{use calc}$$

$$= \boxed{12.287} \quad E$$

OR

plug everything into your calc

$$\text{MATH} \rightarrow \text{nDeriv}(4 \sin(x) + \sin(12x), x, 1)$$

$$= \boxed{12.287}$$

BC #1

30

30. As a cup of hot chocolate cools, its temperature after t minutes is given by $H(t) = 70 + ke^{-0.4t}$. If its initial temperature was 120°F , what was its average temperature (in $^\circ\text{F}$) during the first 10 minutes?

(A) 60.9 (B) 82.3 (C) 95.5 (D) 96.1 (E) 99.5

$$H(t) = 70 + ke^{-0.4t}$$

* initial temp. = 120° , which means at 0 minutes the temp is 120° .

$$\text{so at } t=0, H(t) = 120^\circ$$

First, let's find k . plug in $H(t) = 120^\circ$ and $t=0$

$$120 = 70 + ke^0$$

$$120 = 70 + k$$

$$-70 \quad -70$$

$$\boxed{50 = k}$$

$$\text{thus } H(t) = 70 + 50e^{-0.4t}$$

Next, we need to find the average temp, thus integrate and divide by 10.

$$\frac{1}{10-0} \int_0^{10} 70 + 50e^{-0.4t} dt$$

$$\frac{1}{10} \int_0^{10} 70 + 50e^{-0.4t} dt$$

* plug into your calc

$$\begin{aligned} \text{MATH} &\rightarrow \text{fnInt}(70 + 50e^{-0.4x}, x, 0, 10) \text{ then } \div 10. \\ &= 82.27 = \boxed{82.3} \quad \text{B} \end{aligned}$$

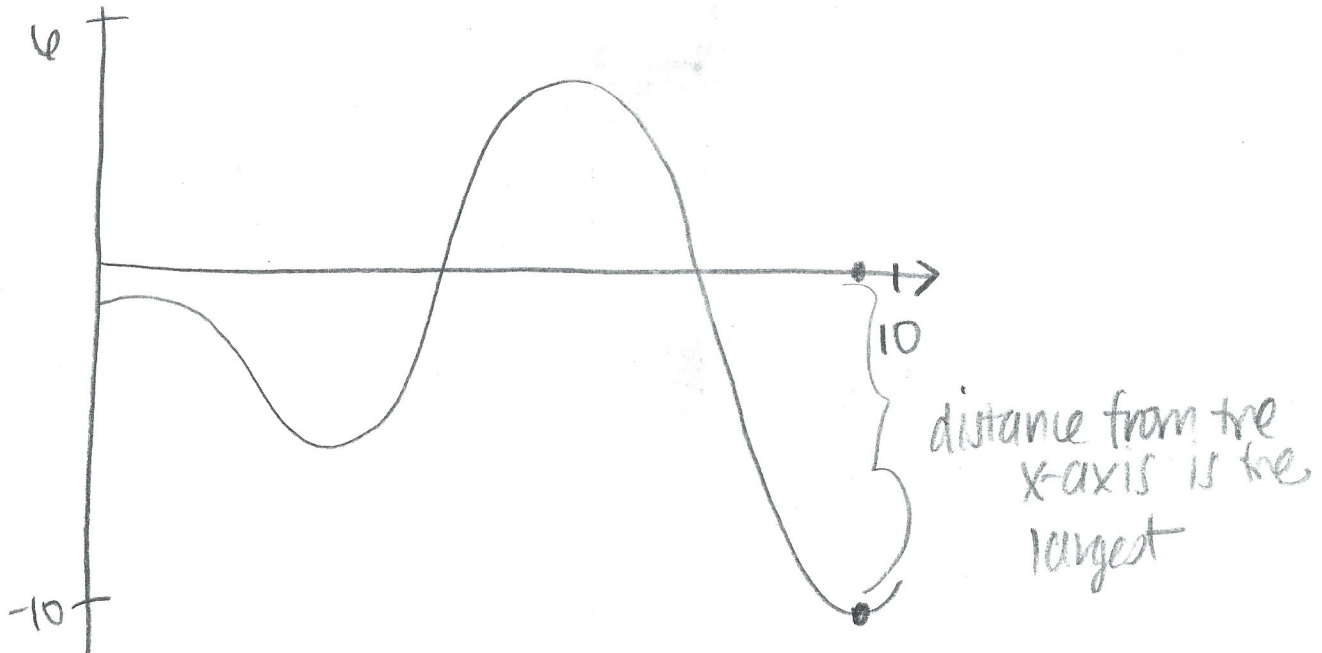
BC #1

31

31. An object moving along a line has velocity $v(t) = t \cos t - \ln(t+2)$, where $0 \leq t \leq 10$. The object achieves its maximum speed when $t =$

- (A) 3.743 (B) 5.107 (C) 6.419 (D) 7.550 (E) 9.538

* graph $v(t) = t \cos t - \ln(t+2)$ on your calc.



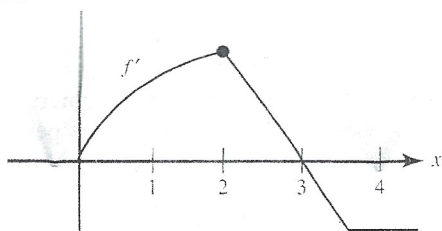
Speed of a particle is $|v|$, the magnitude of v .

* where do we have the largest $|y\text{-value}|$

* at what t -value is the $(y\text{-value})$ the largest

* with your calc find the min. value

$$\boxed{x = 9.538} \quad E$$



32. The graph of f' , which consists of a quarter-circle and two line segments, is shown above. At $x = 2$ which of the following statements is true?

- (A) f is not continuous.
- (B) f is continuous but not differentiable.
- (C) f has a relative maximum.
- (D) The graph of f has a point of inflection.
- (E) none of these

- We are given the graph of f'
- if we look at the slope of this graph = f''
we see that on

$[0, 2]$ the slope is positive, thus $f'' > 0$
and

$[2, 3]$ the slope is negative, thus $f'' < 0$

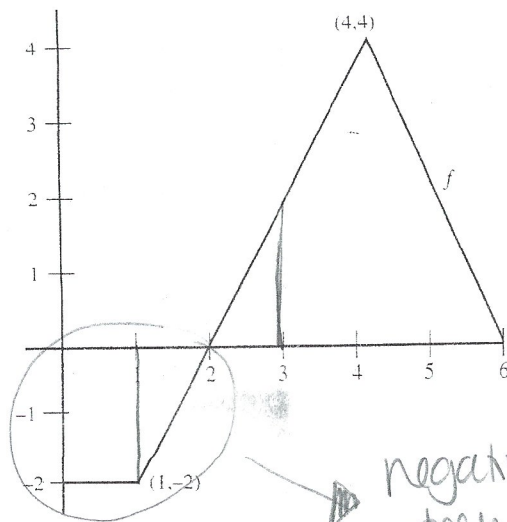
* If f'' changes from positive to negative
Thus concavity is changing from
concave up to concave down.

Thus, we have an inflection point D

BC #1

33. Let $H(x) = \int_0^x f(t) dt$, where f is the function whose graph appears below.

33



negative since they are below the x-axis

The tangent line approximating $H(x)$ near $x=3$ is $H(x) \approx$

- (A) $-2x + 8$ (B) $2x - 4$ (C) $-2x + 4$ (D) $2x - 8$ (E) $2x - 2$

near $x=3$, plug in 3 for x

$H(3) = \int_0^3 f(t) dt$ Find the area under the curve from 0 to 3
(refer to graph)

$$-1(2) - \frac{1}{2}(1)(2) + \frac{1}{2}(1)(2) = -2$$

Thus, $H(3) = -2$, so $(3, -2)$

We need to write an equation of a line.

lets find $m = \text{slope} = \text{derivative}$ $H'(x) = \frac{d}{dx} \int_0^x f(t) dt$

$$H'(x) = f(x)$$

$$\text{so } H'(3) = f(3) = 2$$

$$\text{so } \boxed{m = 2}$$

lets find b , using $m=2$ and $(3, -2)$

$$y = mx + b$$

$$-2 = 2(3) + b$$

$$-2 = 6 + b$$

$$b = -8$$

$$\boxed{y = 2x - 8} \quad \text{D}$$

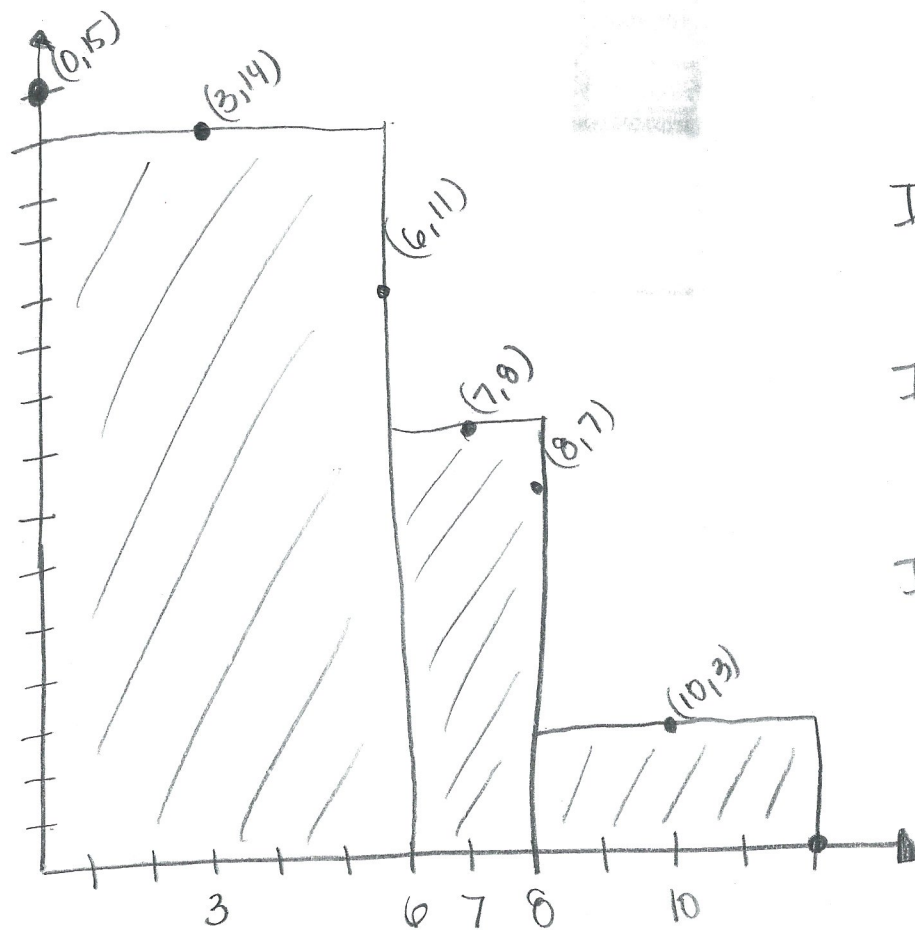
BC #1

34. The table shows the speed of an object, in feet per second, at various times during a 12-second interval.

time (sec)	0	3	6	7	8	10	12
speed (ft/sec)	15	14	11	8	7	3	0

Estimate the distance the object travels, using the midpoint method with 3 subintervals.

- (A) 100 ft (B) 101 ft (C) 111 ft (D) 112 ft (E) 150 ft



Interval #1: $[0, 6]$
midpoint = 3

Interval #2: $[6, 8]$
midpoint = 7

Interval #3: $[8, 12]$
midpoint = 10

$$6(14) + 2(8) + 4(3) = \boxed{112} \quad D$$