BC #1

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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 $t = 1$

$$dy = 4\cos(1) + \cos(12)\cdot 12$$ ← use calc

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

OR

plug everything into your calc

MATH → nDeriv(4sin(x)+sin(12x), x, 1)

$$= \boxed{12.287}$$

BC #1

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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 °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°.

so at $t=0$, $H(t) = 120°$

First, lets find K. plug in $H(t)=120°$ and $t=0$

$120 = 70 + Ke^{0}$

$120 = 70 + K$
$-70 \quad -70$
$\boxed{50 = K}$

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

MATH → fnInt $(70+50e^{-0.4X}, X, 0, 10)$ then ÷10.

$= 82.27 = \boxed{82.3}$ B

BC #1

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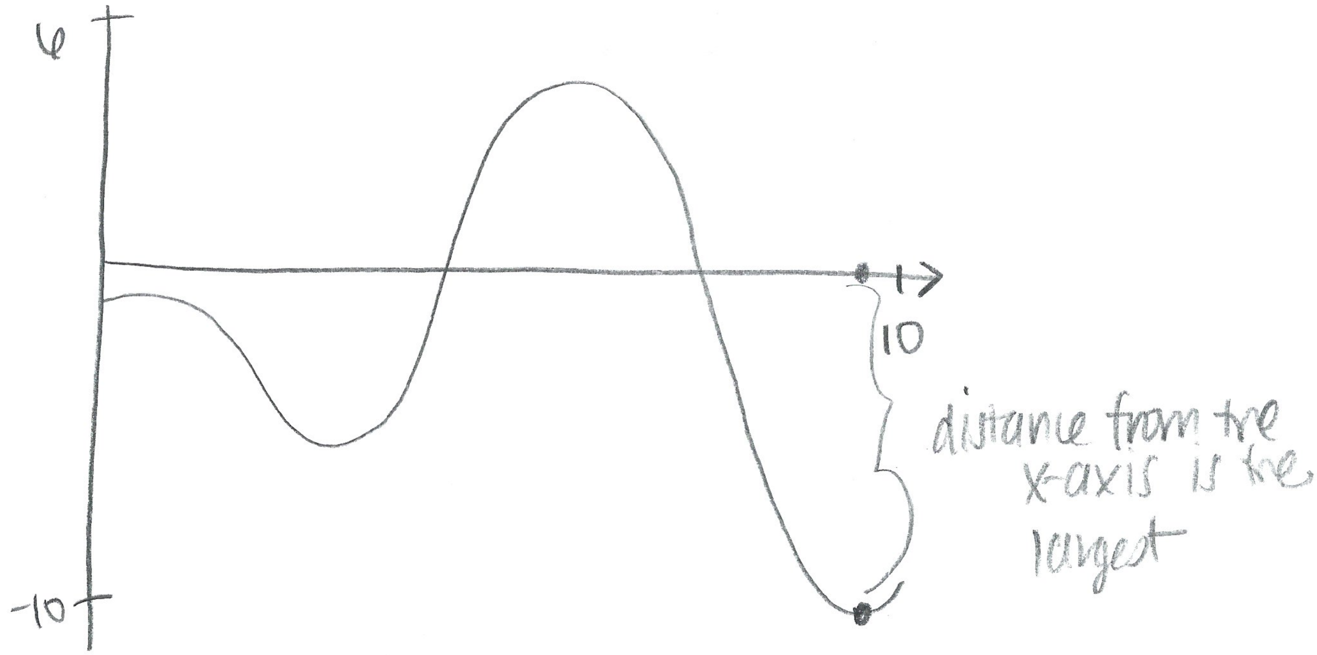
31. An object moving along a line has velocity $v(t) = t\cos t - \ln(t+2)$, where $0 \le t \le 10$. The object achieves its maximum speed when $t =$

(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-value|

* at what t-value is the |y-value| the largest

* with your calc find the min. value

$\boxed{X = 9.539}$ E

BC #1

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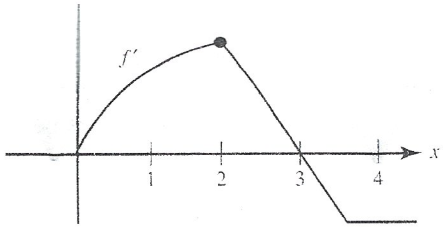

32. The graph of f', which consists of a quarter-circle and two line segments, is shown above. At $x = 2$ which of the following statements is true?

(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~~ 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 $\boxed{\text{inflection point}}$ D

BC#1

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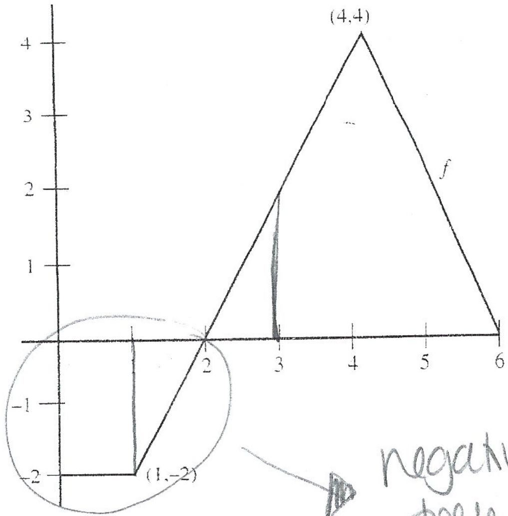
33. Let $H(x) = \int_0^x f(t)dt$, where f is the function whose graph appears below.



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

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

so $H'(3) = f(3) = 2$

so $\boxed{m = 2}$

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

$y = mx + b$

$-2 = 2(3) + b$

$-2 = 6 + b$

$b = -8$

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

BC #1

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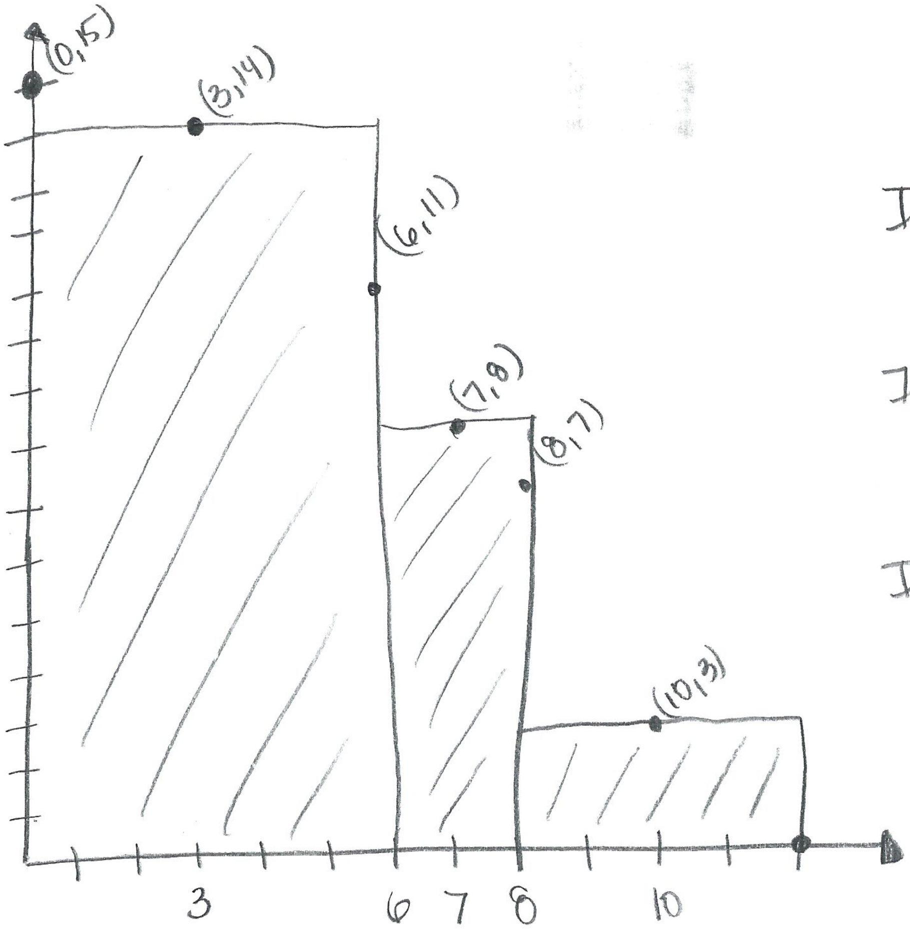
34. The table shows the speed of an object, in feet per second, at various times during a 12-second interval.

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

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