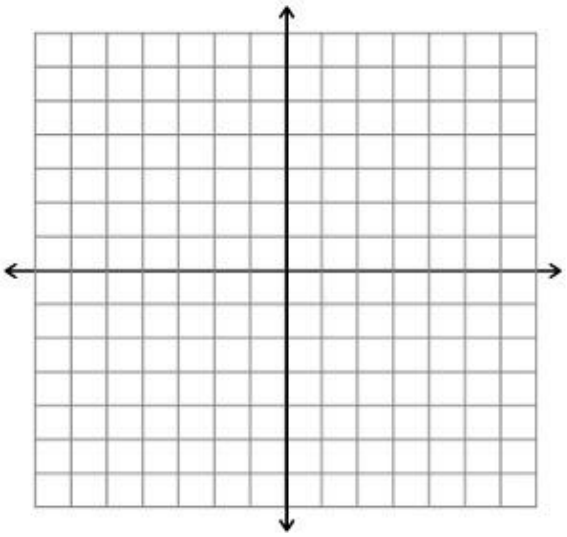
*Unit #12:* Area Under the Curve and Riemann Sums
*Topic:* Using the Area Under the Curve
*Objective: SWBAT evaluate the value of a function by finding the area under the curve using geometric shapes.*

# Warm Up #1:



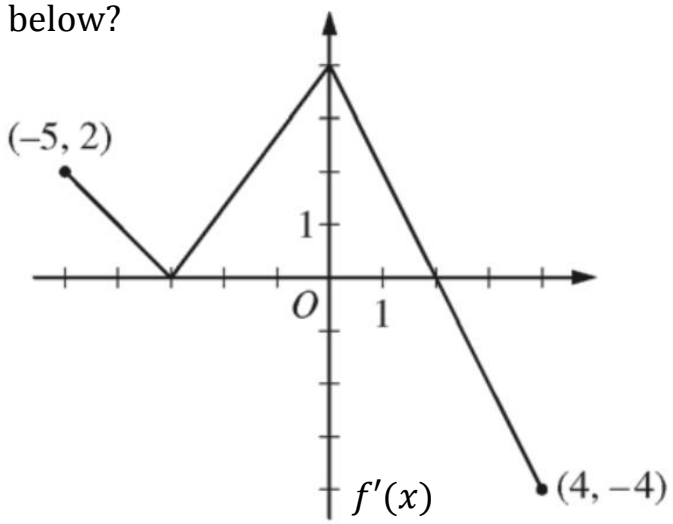
Given the function $f(x) = x^2 + 1$

a) Find $f(0)$ and $f(3)$.

b) Graph the derivative of $f(x)$ and then find the area under the graph from $x = 0$ to $x = 3$. What do you notice about the answer you get compared to the values found in part (a)?

*Conclusion:* _____

*Now, try this*: If we know $f(2) = -3$, how can we find each of the following values given the graph of $f'(x)$ shown below?




| | |
|---|---|
| 1) $f(-3) =$ | 2) $f(4) =$ |
| 3) $f(0) =$ | 4) $f(-5) =$ |

***Defintion:***

If $f$ is continuous on the closed interval $[a, b]$, then the area of the region bounded by the graph of $f$, the $x$-axis, and the vertical lines $x = a$ and $x = b$ is given by

$$area = \int_a^b f(x)dx$$

This is known as the _____ or the _____.

"**Negative area**" is the result of having a function go ***below*** **the $x$ −axis**.

*When we evaluate the derivative we are finding the rate of change at*

_____ *in time.*

*When we evaluate the integral we are finding change*

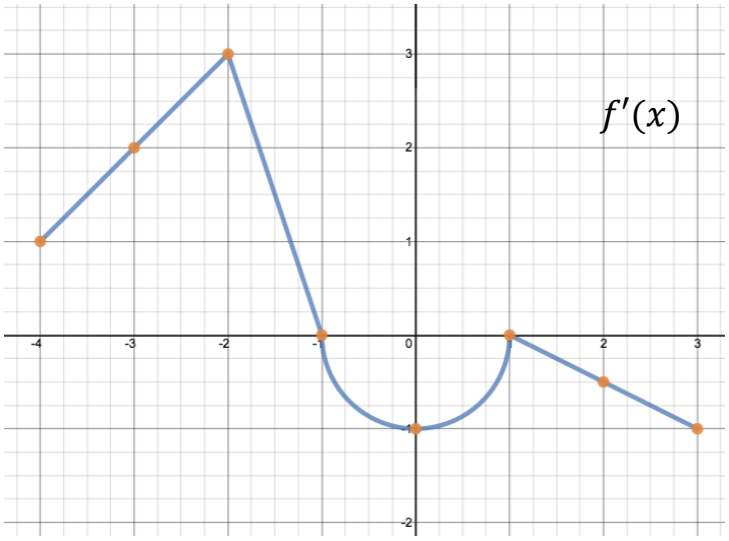
_____ *of time.*

*Some things to remember:*

| | |
|---|---|
| $\int_a^a f(x)dx =$ _____ | If $a < b$ on $[a, b]$, then $\int_b^a f(x)dx =$ _____ |
| If $a < b < c$ on $[a, c]$, then $\int_a^c f(x)dx =$ _____ | |

*Examples:* Find the value of each of the following using the given information. Write out any integral expression(s) used.

1) $f(1) = 7$




| | |
|---|---|
| a) $f(-3) =$ | b) $f(2) =$ |
| c) $f(0) =$ | d) $f(3) =$ |

2) $\int_2^4 x^3 dx = 60$ , $\int_2^4 x dx = 6$ , $\int_2^4 dx = 2$ , $\int_2^7 x^3 dx = -20$ , $\int_0^2 x dx = 1$

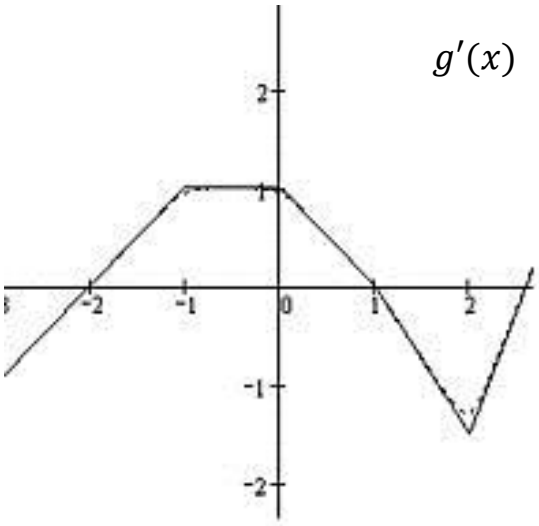
| | |
|---|---|
| a) $\int_2^4 4x dx$ | b) $\int_2^4 \left(\frac{1}{2}x^3 - 3x + 2\right) dx$ |
| c) $\int_4^2 -5x^3 dx$ | d) $\int_0^4 x dx$ |
| e) $\int_4^7 x^3 dx$ | f) $\int_2^4 \frac{x^3 - x}{2} dx$ |

## *Problem Set #1:*

1) If $g(0) = -3$, find

a) $g(-3) =$

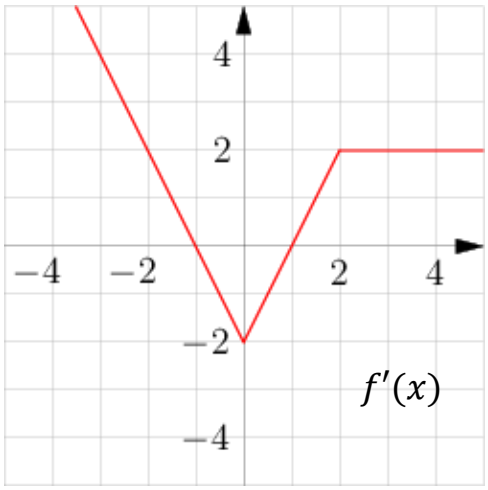
b) $g(2) =$




2) If $f(x) = \int_{-1}^{x} f'(x)dx$, find

a) $f(-4) =$

b) $f(3) =$



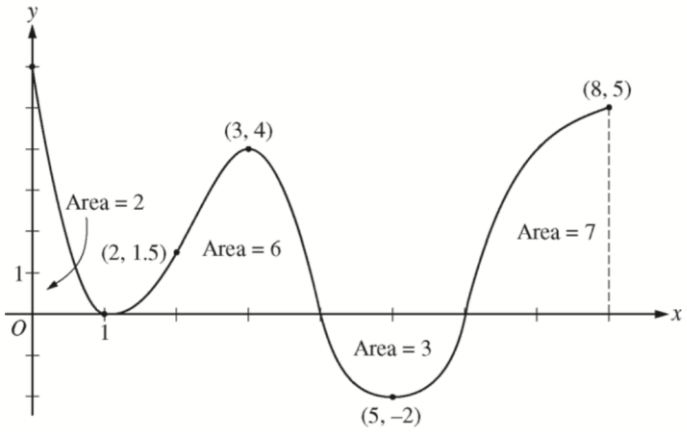

3) If $\int_{-1}^{5} h(x)dx = -11$, $\int_{-1}^{3} h(x)dx = 4$, *and* $\int_{5}^{8} h(x)dx = 2$, find

a) $\int_{3}^{5} h(x)dx$

b) $\int_{-1}^{8} h(x)dx$

c) $\int_{3}^{-1} 6h(x)dx$

4) Given the graph below and that $f(4) = -2$, find




Graph of $f'$

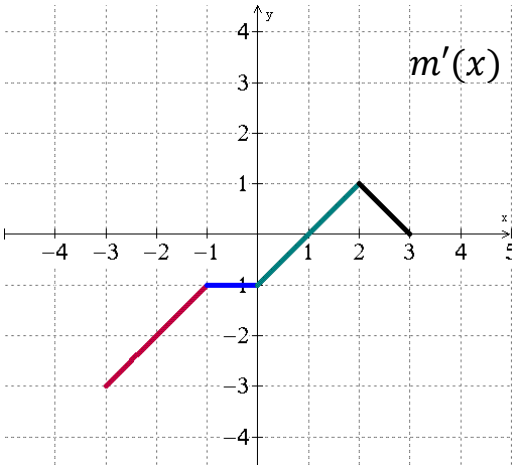
a) $f(8) =$

b) $f(1) =$

5) If $m(0) = 23$, find

a) $m(-3) =$

b) $m(2) =$




c) $m(-2) =$

6) If $\int_6^{-2} g(x)dx = 8$, $\int_{-2}^{6} f(x)dx = -2$, *and* $\int_{-7}^{-2} g(x)dx = -11$, find

a) $\int_{-2}^{6} 5f(x) + g(x)dx$

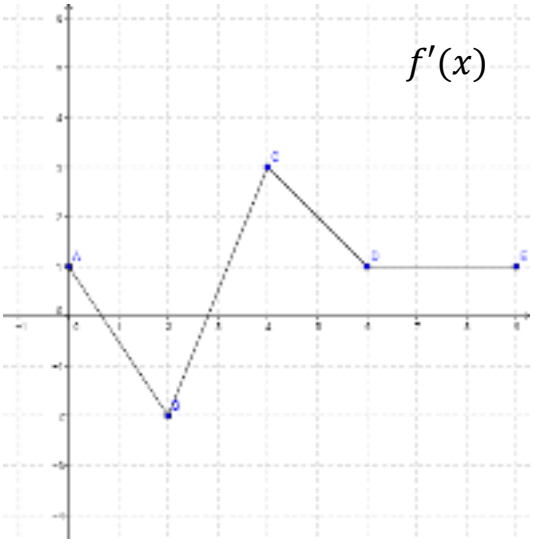
b) $\int_{-7}^{6} g(x)dx$

7) If $f(2) = -5$, find

a) $f(0) =$

b) $f(8) =$

c) $f(5) =$




8) Given the graph of $h'(x)$, find

a) $\int_{-4}^{4} h'(x)dx =$

b) $\int_{2}^{2} h'(x)dx =$

c) $\int_{4}^{0} h'(x)dx =$