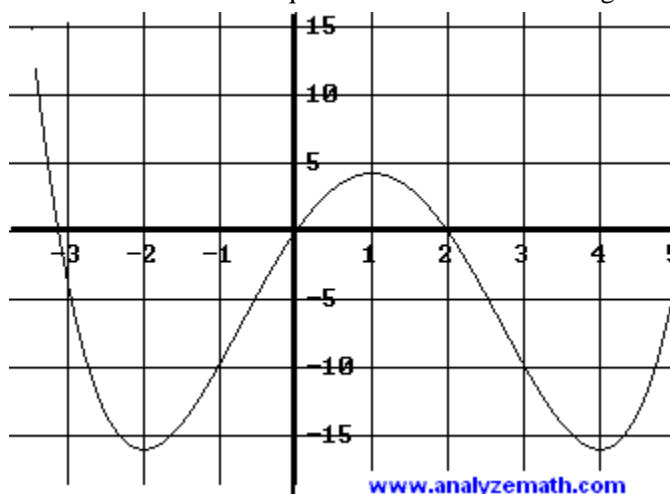


## Calculus Review

Hello young physicists! Welcome to AP Physics C. Besides standing for cool, the “C” means calculus so your first mission is to complete this calculus review. If you will be taking calculus for the first time next year, we will need to catch you up! Send me an email:

### Derivatives

1. Below is the graph of function  $f$ . Answer the questions below for the range  $-4 < x < 5$ .



- For what values of  $x$  is  $f'(x)$  zero?
- For what values is  $f(x)$  increasing? What is the sign of  $f'(x)$  at these values?
- For what values is  $f(x)$  decreasing? What is the sign of  $f'(x)$  at these values?
- Over what intervals is  $f(x)$  concave up? What is the sign of  $f''(x)$  for these values?
- Over what intervals is  $f(x)$  concave down? What is the sign of  $f''(x)$  for these values?
- On the graph above, in a different color pen, sketch an approximate graph of  $f'(x)$ .

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2. Find the first, second and third derivatives of the functions listed below ( $y$  is a function of  $x$ ).

a.  $y = x^2 - 5$

$y'$	$y''$	$y'''$

b.  $y = x^3 + 2x + 1$

$y'$	$y''$	$y'''$

c.  $y - 2x = x^4 - 3x^2 - 6x + 4$

$y'$	$y''$	$y'''$

d.  $y = 5 / x^2$

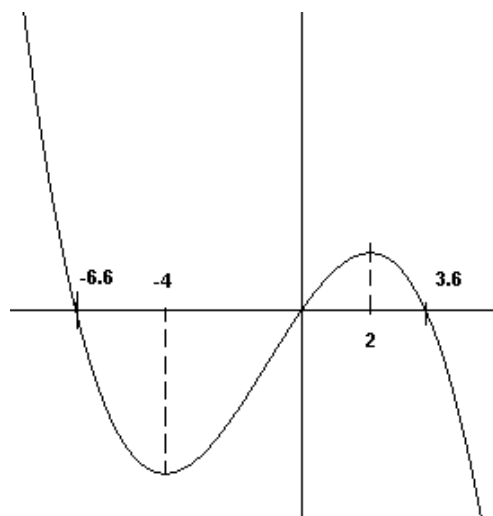
$y'$	$y''$	$y'''$

e.  $y = x^{1/2} + x^{-1/2}$

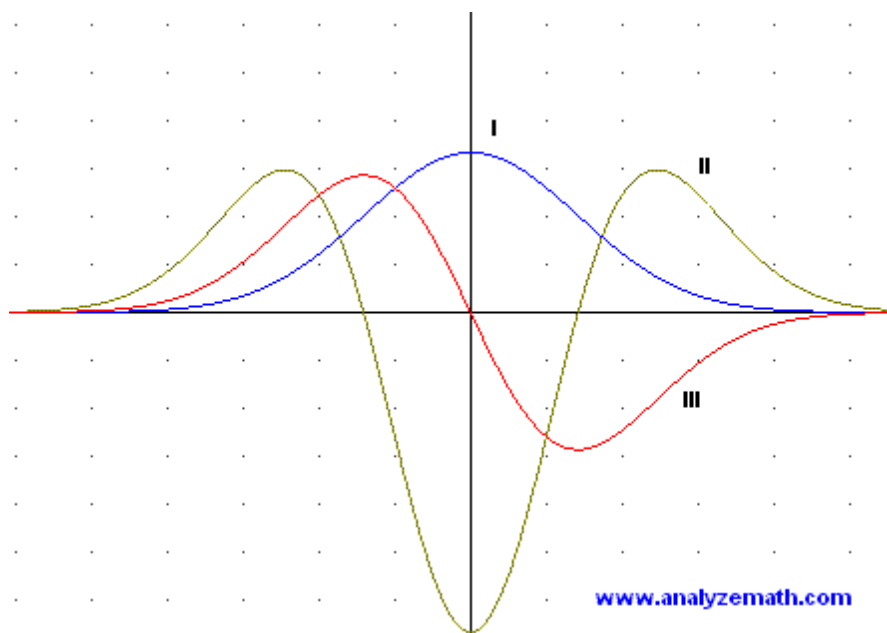
$y'$	$y''$	$y'''$

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3. The graph of the first derivative  $f'$  of function  $f$  is shown to the right:



- For what values of  $x$  is  $f$  increasing?
  - For what values of  $x$  is  $f$  decreasing?
  - For what value(s) of  $x$  does  $f$  have a local maximum or minimum?
  - For what value(s) of  $x$  is the graph of  $f$  concave up? concave down?
  - Where are the points of inflection of the graph of  $f$  located?
  - On the graph above, in a different color pen, sketch an approximate graph of  $f(x)$ . Assume  $f(0) = 0$ .
4. The graphs of function  $f$ , its first  $f'$  and second derivatives  $f''$ , are shown below. Identify the graph of function  $f$ , the graph of its first derivative  $f'$  and the graph of its second derivative  $f''$ .



**Calculus Review****5. Integrals**

Find the integral for each of the functions listed below ( $y$  is a function of  $x$ ), and then evaluate over the interval in the box to the right (only evaluate if the function is continuous).

a.  $y = x^2 - 5$

$\int y dx$	Evaluated over $-3 \leq x \leq 5$
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b.  $y = x^3 + 2x + 1$

$\int y dx$	Evaluated over $-3 \leq x \leq 5$
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c.  $y - 2x = x^4 - 3x^2 - 6x + 4$

$\int y dx$	Evaluated over $-3 \leq x \leq 5$
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d.  $y = 5 / x^2$

$\int y dx$	Evaluated over $-3 \leq x \leq 5$
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e.  $y = x^{1/2} + x^{-1/2}$

$\int y dx$	Evaluated over $-3 \leq x \leq 5$
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**Calculus Review**