

AP Calculus AB/BC - Integration and Accumulation of Change

Show all your work. Clearly indicate the methods you use, because you will be scored on the correctness of your methods as well as on the accuracy and completeness of your results and explanations. Use complete sentences for all explanations.

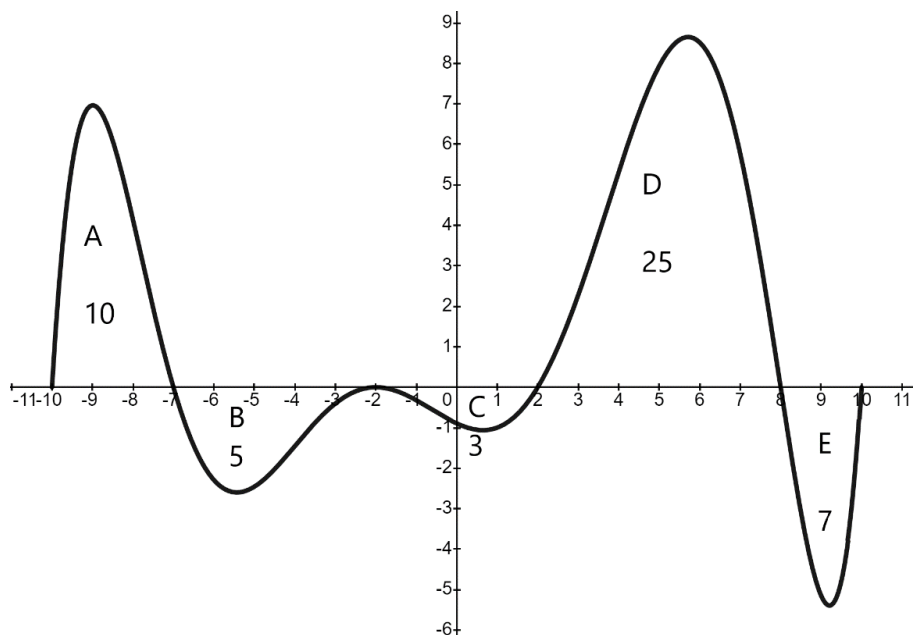
1. The function $M(t): [0,10] \rightarrow R$ is differentiable, decreasing, and concave up. Selected values are given in the table below.

t	0	2.5	6	7	10
$M(t)$	5	2	0.4	0.2	0

- a) Make a rough sketch of this function. Remember the function has the values above, and is differentiable, decreasing, and concave up in $[0,10]$.
- b) Use the values from this table to write the trapezoidal sum.
- c) Write an expression for the integral being approximated by the trapezoidal sum. Is the trapezoidal sum an overestimate or underestimate of the integral $\int_0^{10} M(t) dt$? Explain.

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2. A graph of the continuous function f is shown below. The regions A, B, C, D, and E have areas 10, 5, 3, 25, and 7, respectively.



The function $g: [-10, 10] \rightarrow \mathbb{R}$ is defined by the integral

$$g(x) = \int_{-2}^x f(t) dt - 4$$

a) Evaluate $g(8)$

b) Evaluate $g(-10)$

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- c) Is there a value of $x \in [2,8]$ (an x value in the D region) where $g(x) = 0$? Why or why not?
- d) Find the expression for $g'(x)$.
- e) Find the absolute maximum of $g(x)$. Explain your reasoning by incorporating $g'(x)$.
- f) Find the absolute minimum of $g(x)$. Explain your reasoning by incorporating $g'(x)$.
- g) Calculate $\int_{-10}^{-7} f(2x + 22)dx$

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3. Let the function $f: [0,10] \rightarrow \mathbb{R}$ be defined by

$$f(x) = \int_0^x \ln\left(\frac{1}{6}(t^2 - 8t + 18)\right) dt$$

- a) Find, if any, the interval(s) where f is decreasing.
- b) In which interval is f concave up and decreasing?
4. Compute the following integrals. If a particular technique is specified, you must use it.

a) $\int x^2 \sqrt{5 + 2x^3} dx$ by (u) substitution

b) $\int_0^{\frac{1}{2}} \frac{\sqrt{x}}{\sqrt{1-x}} dx$ by using $\sqrt{x} = \sin y$

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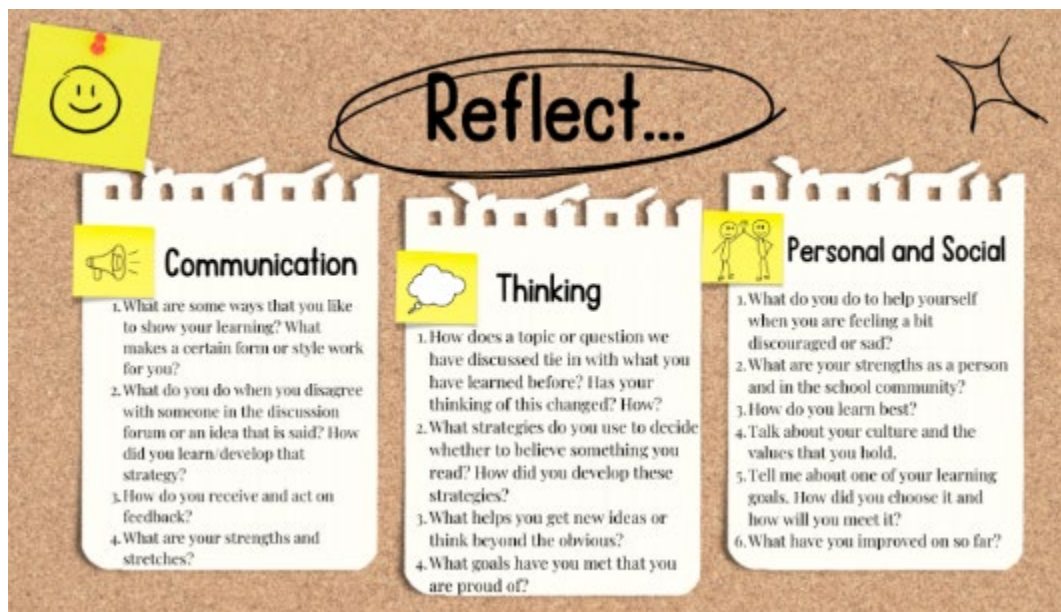
c) $\int \frac{1}{2x^2 - 12x + 26} dx$ by completing the square

d) $\int \frac{4x^3}{x-2} dx$ by long division

e) $\int \frac{x^5}{x^2 - 2x + 1} dx$

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5. Think about your learning journey in this unit. Pick a category and write a response to ONE of the category's questions in a few complete sentences.



~The End~

Quick checklist:

Did you...

- ☐ State your final answer and explanations using full sentences?
- ☐ Explain in a few sentences every time you have a Yes/No answer?
- ☐ Use equal signs correctly where necessary?