

Time to conquer Calculus!

Refresh your memory or practice new concepts in calculus with these advanced problems.

Use Photomath to check your answers or to help you work through steps when you're stuck. In some cases, you will need to apply multiple math concepts to determine the best or most appropriate solution format. Full solutions are at the end for your reference.

Question 1. The graph of the following equation $y = \frac{-5}{x-2}$ is concave downward for all values of x such that:

- A. $x < 0$ B. $x < 2$ C. $x < 5$ D. $x > 0$ E. $x > 2$

Question 2. For the following functions, find the domain and/or the y-intercept.

A. $y = e^{3x/(2x-1)}\sqrt[3]{x-7}$

B. $y = \log_3(5x-2)$

Question 3. Which of the following functions are continuous for all real numbers x ?

A. $y = x^{\frac{5}{3}}$

B. $y = \sqrt[3]{3x - 1}$

C. $y = \frac{3x - 1}{4x^2 + 5}$

- A. None of these B. A only C. B only
D. A, B only E. B, C only F. A, B, and C

Question 4. Evaluate each limit:

A. $\lim_{x \rightarrow \infty} \frac{x^2 + 5x + 6}{x^2 - 4}$

B. $\lim_{k \rightarrow -1} \sqrt[3]{\frac{3k - 5}{25k - 2}}$

C. $y = \lim_{x \rightarrow \frac{1}{3}} \frac{3x^2 - 7x + 2}{-6x^2 + 5x - 1}$

Question 5. Find the limit

$$\lim_{x \rightarrow 2} \left(\frac{x^2 - 4}{x - 2} \right)$$

- A. 4 B. 0 C. 1 D. 3 E. 2

Question 6. Find the derivative for each of the following equations

Hint: Substitute $y =$ with $\frac{d}{dx}$ in the editing tool on Photomath to solve the derivative

A. $2 \sin x 2 \cos x$

B. $y = \tan x - x$

C. $y = \tan^3 x$

D. $y = 3 \cos x$

Question 7. Find the area of the region bounded by the graphs of

$y = x^2 + 1$, $y = -x$, $x = 0$ and $x = 1$

Question 8. If $y = \ln(x\sqrt{x^2 + 1})$, then $\frac{dy}{dx} =$

A. $1 + \frac{x}{x^2 + 1}$

B. $1 + \frac{1}{x\sqrt{x^2 + 1}}$

C. $\frac{2x^2 + 1}{x\sqrt{x^2 + 1}}$

D. $\frac{2x^2 + 1}{x\sqrt{x^3 + x}}$

Question 9. Calculate the derivative:

A. $\frac{d}{dx}(\sqrt{2} \times \sin(3x))$

B. $\frac{d}{dx}((x^2 - 2x + 2)e^x)$

C. $\frac{d}{dx}(\ln(\frac{1 + x^2}{1 - x^2}))$

Question 10. Find the following integrals.

A. $\int \frac{7\sqrt{x} - 3x^2 - 3}{4\sqrt{x}} dx$

B. $\int_{-\frac{\pi}{3}}^{\frac{\pi}{3}} 4 \sec \theta \tan \theta d\theta$

C. $\int_0^{\frac{\pi}{2}} \cos\left(\frac{2x}{3}\right) dx$

Solutions

Question 1: E

Solving with Photomath

- Scan the equation in Photomath to graph it. Review the vertical intercept (the asymptote) and compare where the values fall in relation to the curves

Question 2:

Domain = $x \neq \frac{1}{2}$, y-intercept $(0, -\sqrt[3]{7})$

Root = $(\frac{3}{5}, 0)$ Domain $x > \frac{2}{5}$

Solving with Photomath

- Scan problem to check your answer with Photomath

Question 3: A

Solving with Photomath

- Scan each equation in Photomath to graph it, then determine if there are any with breaks in the curve

Question 4:

A. 1

B. $\frac{2}{3}$

C. -5

Question 5: A

Question 6:

A. $2 \cos(2x)$

B. $\tan(x)^2$

C. $\frac{3 \sin(x)^2}{\cos(x)^4}$

D. $-3 \sin(x)$

Solving with Photomath

- Scan the equation in Photomath. Switch to the calculator and substitute $y =$ with $\frac{d}{dx}$. To find $\frac{d}{dx}$, tap "... " on the bottom left of the calculator for the secondary keyboard. Make sure all parentheses are in the correct place

or

- Rewrite the solution by hand replacing $y =$ with $\frac{d}{dx}$ and then scan new formula with Photomath

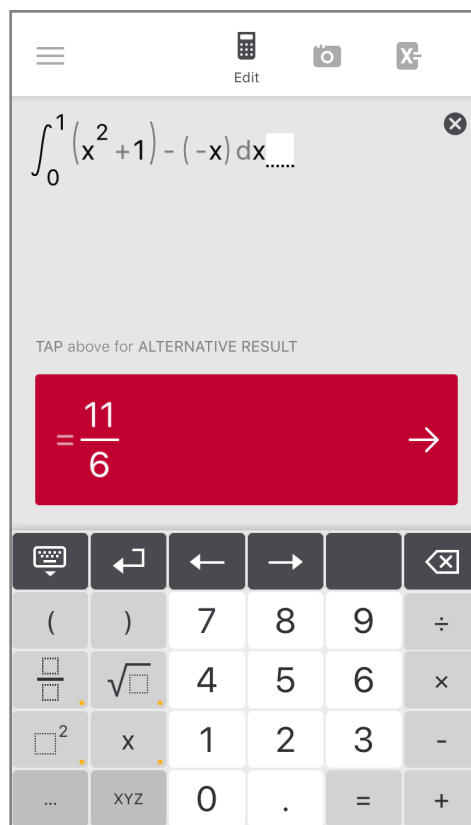
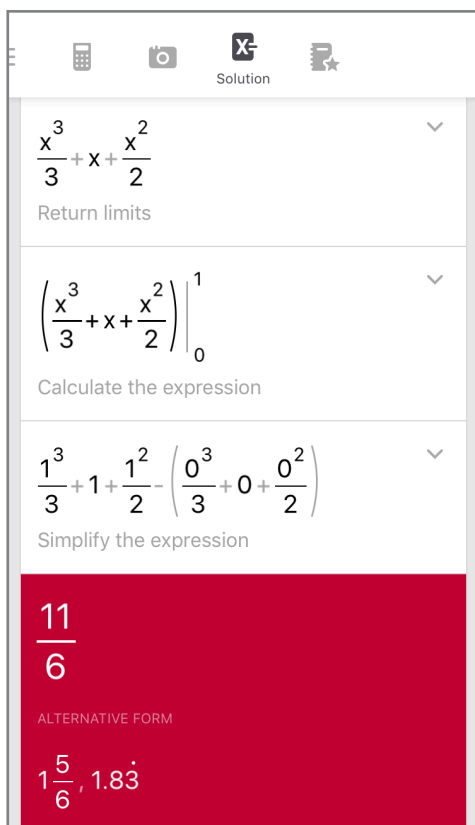


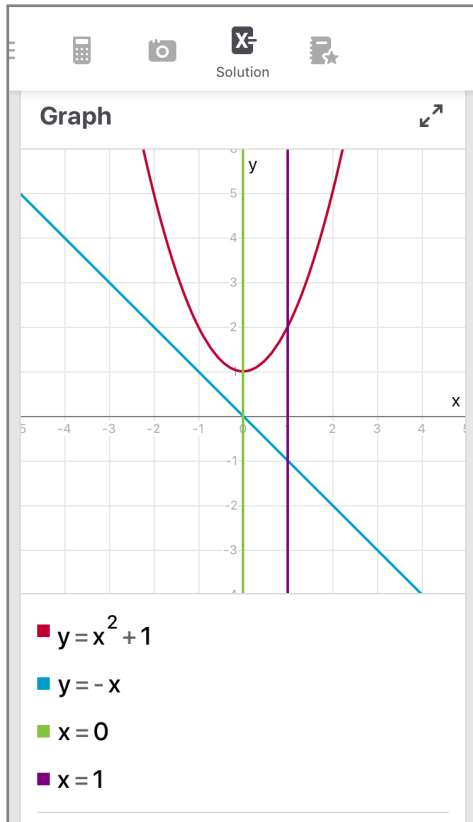
Question 7: $\frac{11}{6}$

Solving with Photomath

Note: The area is bounded by the graphs of $y = x^2 + 1$, $y = -x$, $x = 0$ and $x = 1$

- Graph each function by typing each one into Photomath's calculator. Review the bounded area
- From the graph we see that $y = x^2 + 1$ is greater than $y = -x$ from $x = 0$ to $x = 1$. Therefore to calculate the area we need to calculate the integral
- Scan the integral to get the solution





Solving Steps

$$\begin{cases} y = x^2 + 1 \\ y = -x \\ x = 0 \\ x = 1 \end{cases}$$
 Move term
Simplify

$$\begin{cases} y - x^2 = 1 \\ x + y = 0 \\ x = 0 \\ x = 1 \end{cases}$$
 The system has no solution

$(x, y) \in \emptyset$

Graph

Question 8: D

Solving with Photomath

- Scan the right side equation. Go to the calculator screen and plug the $\frac{d}{dx}$ function in front of the equation. Make sure parentheses surround the whole equation

The image shows the Photomath calculator interface. At the top, there are icons for a menu, calculator, camera, and a close button. Below these, the text "Edit" is visible. The main display area shows the derivative expression $\frac{d}{dx}(\ln(x\sqrt{x^2+1}))$. Below the display, a red box contains the result $\frac{2x^2+1}{x^3+x}$ with a right-pointing arrow. At the bottom, there is a numeric keypad with various mathematical symbols like parentheses, square root, and exponents.

The image shows the "Solution" screen in Photomath. It displays the following steps:
1. **Solving Steps**: $\frac{d}{dx}(\ln(x\sqrt{x^2+1}))$. Instruction: Use Differentiation Rules.
2. $\frac{d}{dx}(\ln(g)) \times \frac{d}{dx}(x\sqrt{x^2+1})$. Instruction: Calculate the derivatives.
3. $\frac{1}{g} \times \left(\sqrt{x^2+1} + x \times \frac{1}{2\sqrt{x^2+1}} \times 2x \right)$. Instruction: Return the substitution.
4. $\frac{1}{x\sqrt{x^2+1}} \times \left(\sqrt{x^2+1} + x \times \frac{1}{2\sqrt{x^2+1}} \times 2x \right)$. Instruction: Simplify the expression.
At the bottom, a red box shows the final simplified result: $\frac{2x^2+1}{x^3+x}$.

Question 9:

A. x^2e^2

B. $3\sqrt{2} \times \cos(3x)$

C. $\frac{4x}{1-x^4}$

Question 10:

A. $\frac{7}{4}x - \frac{3x^2\sqrt{x}}{10} - \frac{3}{2} \times \sqrt{x} + C, C \in K$

B. 0

C. $\frac{3\sqrt{3}}{4}$