Section 3.9 - Antiderivatives

Find the function F, whose derivative is f! SIMPLE!

$f(x) = 3x^2 - 4x + 1$

$F(x) = \frac{3x^3}{3} - \frac{4x^2}{2} + 1x^1 + C$ for any $C \in \mathbb{R}$

$= x^3 - 2x^2 + x + C$

$F'(x) = 3x^2 - 4x + 1$ See? And any C will work!

$\int f(x)\,dx = \int (3x^2 - 4x + 1)\,dx$

$= x^3 - 2x^2 + x + C$

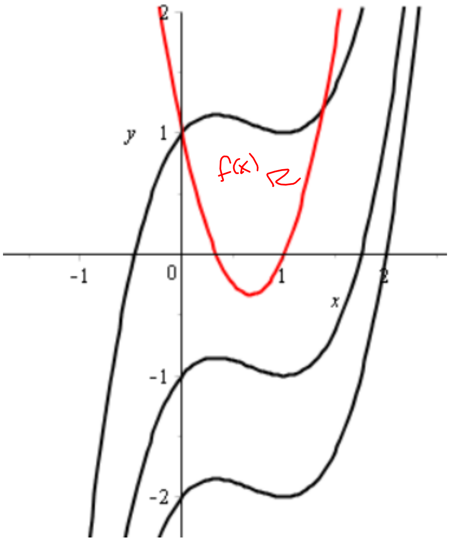
Arbitrary Constant of integration

$\frac{4}{3}\pi r^3$

$4\pi r^2$

$8\pi r$

$\frac{d}{dx}$ $\int$



3 possible $F(x)$'s shown.

$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C$

$\int (3x^2 + 5x)\,dx$

$= 3\int x^2\,dx + 5\int x\,dx$

$\frac{d}{dx}[5x] = 5\left[\frac{d}{dx}[x]\right]$

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1. Question Details SCalc8 3.9.001. [3353918]

Find the most general antiderivative of the function. (Check your answer by differentiation. Use C for the constant of the antiderivative.)

$f(x) = 8x + 7$

"Constant of the antiderivative" is usually called "Constant of Integration."

$$\Rightarrow F(x) = \frac{8x^2}{2} + 7x + C$$

$$= 4x^2 + 7x + C$$

2. Question Details SCalc8 3.9.002. [3353821]

Find the most general antiderivative of the function. (Check your answer by differentiation. Use C for the constant of the antiderivative.)

$f(x) = x^2 - 5x + 6 \Rightarrow F(x) = \frac{x^3}{3} - \frac{5}{2}x^2 + 6x^1 + C$

3. Question Details SCalc8 3.9.005. [3353662

Find the most general antiderivative of the function. (Check your answer by differentiation. Use C for the constant of the antiderivative.)

$f(x) = x(18x + 6) = 18x^2 + 6x$

$$\Rightarrow \boxed{F(x) = 6x^3 + 3x^2 + C}$$

4. Question Details SCalc8 3.9.007. [3353732]

Find the most general antiderivative of the function. (Check your answer by differentiation. Use C for the constant of the antiderivative.)

$f(x) = 11x^{4/7} + 7x^{-6/7}$

$\frac{4}{7} + \frac{7}{7} = \frac{11}{7}$, $-\frac{6}{7} + \frac{7}{7} = \frac{1}{7}$

$$\Rightarrow F(x) = \frac{11}{\left(\frac{11}{7}\right)} x^{\frac{11}{7}} + \frac{7}{\left(\frac{1}{7}\right)} x^{\frac{1}{7}} + C$$

$$= \boxed{7x^{\frac{11}{7}} + 49x^{\frac{1}{7}} + C}$$

5. Question Details SCalc8 3.9.009. [3353802]

Find the most general antiderivative of the function. (Check your answer by differentiation. Use C for the constant of the antiderivative.)

$f(x) = \sqrt{6} \Rightarrow \boxed{F(x) = \sqrt{6}\,x + C}$

6. Question Details SCalc8 3.9.012. [3353866]

Find the most general antiderivative of the function. (Check your answer by differentiation. Use C for the constant of the antiderivative.)

$f(x) = \sqrt[5]{x^2} + x\sqrt{x} = x^{\frac{2}{5}} + x^{\frac{3}{2}} \Longrightarrow$

$F(x) = \frac{5}{7}x^{\frac{7}{5}} + \frac{2}{5}x^{\frac{5}{2}} + C$

7. Question Details SCalc8 3.9.013. [3353770]

Find the most general antiderivative of the function. (Check your answer by differentiation. Use C for the constant of the antiderivative.)

$f(x) = \frac{10}{x^9} = 10x^{-9} \Longrightarrow F(x) = \frac{10}{-8}x^{-8} + C$

8. Question Details SCalc8 3.9.014.MI. [3391222]

Find the most general antiderivative of the function. (Check your answer by differentiation. Use C for the constant of the antiderivative.)

$g(x) = \frac{3 - 6x^3 + 4x^6}{x^6} = \frac{3}{x^6} - \frac{6x^3}{x^6} + \frac{4x^6}{x^6} = 3x^{-6} - 6x^{-3} + 4$

$\Longrightarrow \boxed{G(x) = -\frac{3}{5}x^{-5} + 3x^{-2} + 4x + C}$

9. Question Details SCalc8 3.9.021. [335382

Find the antiderivative F of f that satisfies the given condition. Check your answer by comparing the graphs of f and F.

$f(x) = 5x^4 - 4x^5, \quad F(0) = 6$

$F(x) = x^5 - \frac{2}{3}x^6 + C$

$F(0) = C = 6$ so $\boxed{F(x) = x^5 - \frac{2}{3}x^6 + 6}$

10. Question Details SCalc8 3.9.023. [

Find f. (Use C for the constant of the first antiderivative and D for the constant of the second antiderivative.)

$f''(x) = 24x^3 - 18x^2 + 10x$

$f'(x) = 6x^4 - 6x^3 + 5x^2 + C \Longrightarrow$

$\boxed{f(x) = \frac{6}{5}x^5 - \frac{3}{2}x^4 + \frac{5}{3}x^3 + Cx + D}$

11. Question Details

Find f.

$f'(t) = \sec(t)(\sec(t) + \tan(t))$, $-\frac{\pi}{2} < t < \frac{\pi}{2}$, $f\left(\frac{\pi}{4}\right) = -4$

$= \sec^2(t) + \sec(t)\tan(t)$

$\frac{d}{dt}[\tan(t)] = \sec^2(t)$

$\frac{d}{dt}[\sec(t)] = \sec(t)\tan(t)$

$\Rightarrow \boxed{f(t) = \tan(t) + \sec(t) + C}$

12. Question Details SCalc8 3.9.044

Find a function f such that $f'(x) = 3x^3$ and the line $24x + y = 0$ is tangent to the graph of f.

$y = -24x$

$m = -24$ is what we want.

$f'(x) = 3x^3 \overset{\text{SET}}{=} -24$

$x^3 = -8$

$x = -2$ is when it happens. want $x = -2$ to hit $y = -24x = G(x)$

$G(-2) = 48$

want

$f(x) = \frac{3}{4}x^4 + C$

want $f(-2) = G(-2)$

$\frac{3}{4}(-2)^4 + C = 48$

$\frac{3}{4}(16) + C = 12 + C = 48$

$\boxed{C = 36}$!

$\boxed{f(x) = \frac{3}{4}x^4 + 36}$

$f'(x) = 3x^3$

$f'(-2) = 3(-2)^3 = 3(-8) = -24$

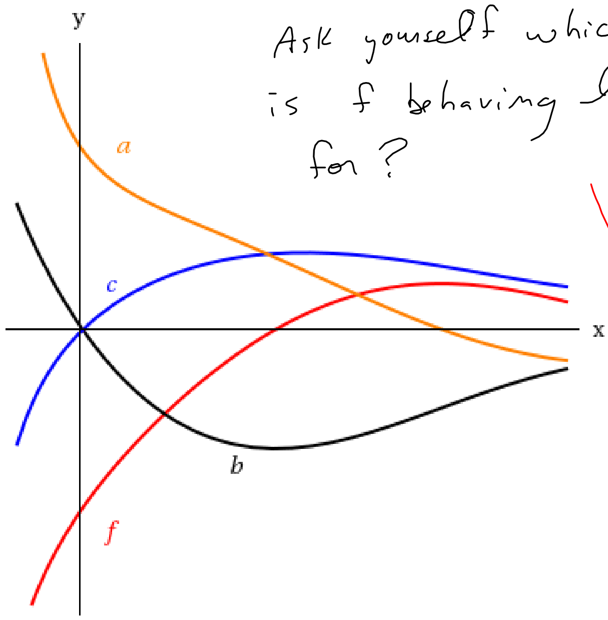
$y = -24(x+2) + f(-2)$

$= -24(x+2) + 48$

$= -24x - 48 + 48 = -24x$

13. Question Details

The graph of a function *f* is shown. Which graph is an antiderivative of *f*?



Ask yourself which function is f behaving like a derivative for?

slope

$$\boxed{b = \int f}$$