

1.  $\int \frac{x^3 + 5}{x^2} dx =$

(A)  $1 - \frac{10}{x^3} + C$

(B)  $\frac{3x}{4} + \frac{15}{x^2} + C$

(C)  $\frac{x^2}{2} - \frac{5}{x} + C$

(D)  $\frac{x^2}{2} - \frac{5}{3x^3} + C$

(E)  $-\frac{x^3}{4} - 5 + C$

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2.  $\int 5x(\sqrt{x} - x^2) dx =$

(A)  $\frac{15\sqrt{x}}{2} - 15x^2 + C$

(B)  $5x - \frac{5x^4}{4} + C$

(C)  $2x^{5/2} - \frac{5x^4}{4} + C$

(D)  $\frac{25x^{5/2}}{2} - \frac{5x^4}{4} + C$

(E)  $\frac{5x^{7/2}}{3} - \frac{5x^6}{6} + C$

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3.  $\int x^2(x^3 + 5)^6 dx =$

(A)  $\frac{1}{3}(x^3 + 5)^6 + C$

(B)  $\frac{1}{3}x^3\left(\frac{1}{4}x^4 + 5x\right)^6 + C$

(C)  $\frac{1}{7}(x^3 + 5)^7 + C$

(D)  $\frac{3}{7}x^2(x^3 + 5)^7 + C$

(E)  $\frac{1}{21}(x^3 + 5)^7 + C$

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4.  $\int \frac{(x^{1/3} - 4)^5}{6x^{2/3}} dx =$

(A)  $\frac{(x^{1/3} - 4)^6}{12} + C$

(B)  $\frac{(x^{1/3} - 4)^6}{6} + C$

(C)  $\frac{5(x^{1/3} - 4)^4}{2} + C$

(D)  $3(x^{1/3} - 4)^6 + C$

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6. Using the substitution  $u = x^2 - 3$ ,  $\int_{-1}^4 x(x^2 - 3)^5 dx$  is equal to which of the following?

(A)  $2 \int_{-2}^{13} u^5 du$

(B)  $\int_{-2}^{13} u^5 du$

(C)  $\frac{1}{2} \int_{-2}^{13} u^5 du$

(D)  $\int_{-1}^4 u^5 du$

(E)  $\frac{1}{2} \int_{-1}^4 u^5 du$

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8.  $\int_0^1 x\sqrt{1+8x^2} dx =$

(A)  $\frac{1}{24}$

(B)  $\frac{13}{12}$

(C)  $\frac{9}{8}$

(D)  $\frac{52}{3}$

(E) 18

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10. If  $\int_0^k \frac{x}{x^2 + 4} dx = \frac{1}{2} \ln 4$ , where  $k > 0$ , then  $k =$

(A) 0

(B)  $\sqrt{2}$

(C) 2

(D)  $\sqrt{12}$

(E)  $\frac{1}{2} \tan(\ln \sqrt{2})$

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11.  $\int (2^t + e^\pi) dt =$

(A)  $\frac{2^{t+1}}{t+1} + \frac{e^{\pi+1}}{\pi+1} + C$

(B)  $\frac{2^t}{\ln 2} + e^\pi t + C$

(C)  $\frac{2^t}{\ln 2} + e^\pi + C$

(D)  $2^t \ln 2 + \frac{e^{\pi+1}}{\pi+1} + C$

(E)  $2^t \ln 2 + e^\pi t + C$

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11.  $\int x \cos(2x) dx =$

(A)  $\frac{1}{2} x^2 \sin(2x) + C$

(B)  $\frac{1}{2} x^2 \cos(2x) + \frac{1}{2} \sin(2x) + C$

(C)  $\frac{1}{2} x \sin(2x) - \frac{1}{4} \cos(2x) + C$

(D)  $\frac{1}{2} x \sin(2x) + \frac{1}{4} \cos(2x) + C$

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16.  $\int \frac{1+3x}{(1-x)(3x-5)} dx =$

(A)  $2 \ln |1-x| - 3 \ln |3x-5| + C$

(B)  $2 \ln |1-x| - 27 \ln |3x-5| + C$

(C)  $-2 \ln |1-x| - 3 \ln |3x-5| + C$

(D)  $-2 \ln |1-x| - 9 \ln |3x-5| + C$

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17. A spherical snowball is melting in such a way that it maintains its shape. The snowball is decreasing in volume at a constant rate of 8 cubic centimeters per hour. At what rate, in centimeters per hour, is the radius of the snowball decreasing at the instant when the radius is 10 centimeters? (The volume of a sphere of radius  $r$  is  $V = \frac{4}{3} \pi r^3$ .)

(A)  $\frac{1}{50\pi}$       (B)  $\frac{3}{50\pi}$       (C)  $400\pi$       (D)  $3200\pi$

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18.  $\int_1^{\infty} \frac{x^2}{(x^3 + 2)^2} dx$  is
- (A)  $-\frac{1}{9}$     (B)  $\frac{1}{9}$     (C)  $\frac{1}{3}$     (D) 1    (E) divergent
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21.  $\int \frac{6x^2 - 4x - 25}{x - 2} dx =$
- (A)  $3x^2 + 8x - 9 \ln|x - 2| + C$
- (B)  $3x^2 + 8x + \frac{9}{(x - 2)^2} + C$
- (C)  $(2x^3 - 2x^2 - 25x) \ln|x - 2| + C$
- (D)  $\frac{2x^3 - 2x^2 - 25x}{\frac{x^2}{2} - 2x} + C$
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24. Let  $f$  be a differentiable function such that  $\int f(x) \sin x \, dx = -f(x) \cos x + \int 4x^3 \cos x \, dx$ . Which of the following could be  $f(x)$ ?
- (A)  $\cos x$     (B)  $\sin x$     (C)  $4x^3$     (D)  $-x^4$     (E)  $x^4$
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25.  $\int_1^{\infty} xe^{-x^2} dx$  is
- (A)  $-\frac{1}{e}$     (B)  $\frac{1}{2e}$     (C)  $\frac{1}{e}$     (D)  $\frac{2}{e}$     (E) divergent
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27. If  $\int_1^x f(t) dt = \frac{20x}{\sqrt{4x^2 + 21}} - 4$ , then  $\int_1^\infty f(t) dt$  is

- (A) 6      (B) 1      (C) -3      (D) -4      (E) divergent
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28. What are all values of  $p$  for which  $\int_1^\infty \frac{1}{x^{3p+1}} dx$  converges?

- (A)  $p < 0$       (B)  $p > -\frac{1}{3}$       (C)  $p > 0$       (D)  $p > 1$
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