Integration Test … Set 4

In problems 1 through 13, find the indicated integral. Check your answers by differentiation.

1. $\int x^5 dx$
2. $\int x^{\frac{3}{4}} dx$
3. $\int \frac{1}{x^2} dx$
4. $\int 5 dx$
5. $\int (x^{\frac{1}{2}} - 3x^{\frac{2}{3}} + 6) dx$
6. $\int \left(3\sqrt{x} - \frac{2}{x^3} + \frac{1}{x}\right) dx$
7. $\int \left(\frac{e^x}{2} + x\sqrt{x}\right) dx$
8. $\int \left(\sqrt{x^3} - \frac{1}{2\sqrt{x}} + \sqrt{2}\right) dx$
9. $\int \left(\frac{1}{3x} - \frac{3}{2x^2} + e^2 + \frac{\sqrt{x}}{2}\right) dx$
10. $\int \frac{x^2+2x+1}{x^2} dx$
11. $\int x^3 \left(2x + \frac{1}{x}\right) dx$
12. $\int \sqrt{x}(x^2 - 1) dx$
13. $\int x(2x+1)^2 dx$
14. Find the function whose tangent has slope $4x + 1$ for each value of x and whose graph passes through the point $(1, 2)$.
15. Find the function whose tangent has slope $3x^2 + 6x - 2$ for each value of x and whose graph passes through the point $(0, 6)$.
16. Find a function whose graph has a relative minimum when $x = 1$ and a relative maximum when $x = 4$.
17. It is estimated that t months from now the population of a certain town will be changing at the rate of $4 + 5t^{\frac{2}{3}}$ people per month. If the current population is 10000, what will the population be 8 months from now?
18. An environmental study of a certain community suggests that t years from now the level of carbon monoxide in the air will be changing at the rate of $0.1t + 0.1$ parts per million per year. If the current level of carbon monoxide in the air is 3.4 parts per million, what will the level be 3 years from now?
19. After its brakes are applied, a certain car decelerates at the constant rate of 6 meters per second per second. If the car is traveling at 108 kilometers per hour when the brakes are applied, how far does it travel before coming to a complete stop? (Note: 108 kmph is the same as 30 mps.)
20. Suppose a certain car supplies a constant deceleration of A meters per second per second. If it is traveling at 90 kilometers per hour (25 meters per second) when the brakes are applied, its stopping distance is 50 meters.
    (a) What is A?
    (b) What would the stopping distance have been if the car had been traveling at only 54 kilometers per hour when the brakes were applied?
    (c) At what speed is the car traveling when the brakes are applied if the stopping distance is 56 meters?

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Answers

1. $\frac{1}{6}x^6 + C$
2. $\frac{4}{7}x^{\frac{7}{4}} + C$
3. $-\frac{1}{x} + C$
4. $5x + C$
5. $\frac{2}{3}x^{\frac{3}{2}} - \frac{9}{5}x^{\frac{5}{3}} + 6x + C$
6. $2x^{\frac{3}{2}} + \frac{1}{x^2} + \ln|x| + C$
7. $\frac{1}{2}e^x + \frac{2}{5}x^{\frac{5}{2}} + C$
8. $\frac{2}{5}\sqrt{(x^3)}x - \sqrt{x} + \sqrt{2}x + C$
9. $\frac{1}{3}\ln|x| + \frac{3}{2x} + e^2x + \frac{1}{3}x^{\frac{3}{2}} + C$
10. $x - \frac{1}{x} + 2\ln x + C$
11. $\frac{2}{5}x^5 + \frac{1}{3}x^3 + C$
12. $\frac{2}{7}x^{\frac{7}{2}} - \frac{2}{3}x^{\frac{3}{2}} + C$
13. $x^4 + \frac{4}{3}x^3 + \frac{1}{2}x^2 + C$
14. $f(x) = 2x^2 + x - 1$
15. $f(x) = x^3 + 3x^2 - 2x + 6$
16. $f(x) = \frac{1}{3}x^3 - \frac{5}{2}x^2 + 4x$; not unique
17. 10128
18. 4.15 parts per million
19. 75 meters
20. (a) $A = 6.25$
    (b) 42 meters
    (c) 120.37 kilometers per hour