Review: Lessons 1-17

April 27, 2016

1. Compute $\int x(4x^2 + 3)^6 \, dx$.
2. A car's acceleration t minutes from now is $a(t) = 0.3e^{0.45t}$. If the car's current speed is 20 miles per hour, and the speed limit is 70 miles per hour, how long will it take for the car to reach the speed limit?
3. Compute $\int 3\tan(5x) \, dx$.
4. Compute $\int 2\ln x \, dx$. (Hint: Use integration by parts.)
5. Find the area of the region bounded by the curves $y = 3x\sin x$, $y = 0$, $x = 0$, and $x = \pi$.
6. Carbon-14 decays at a rate proportional to it's current amount, and it has a half life of 5730 years. If the original amount was 700mg, how much is left after 3,000 years? After how many years will 100mg be left?
7. It is 25°C today, and it takes a cup of coffee 20 minutes to cool from 100°C to 85°C. How much *longer* will it take to cool to 80°C?
8. Find the particular solution of the equation $t\dfrac{dy}{dt} = y + 3$ if $y(1) = 7$.
9. A 40-gallon tank currently holding 30 gallons of brine contains 2 pounds of dissolved salt. Brine containing 3 pounds of salt per gallon flows into the tank at a rate of 4 gallons per minute, an the well-stirred mixture flows out of the tank at the rate of 2 gallons per minute. How much salt is in the tank when it is full?
10. Find the general solution $y(x)$ if $x^2\dfrac{dy}{dx} - 4y = 10$. (Hint: Use an integrating factor.)
11. Find the area of the region bounded by the curves $y = x^2 - 9x$ and $y = x - 9$.
12. Find the volume of the solid generated by revolving the region bounded by $y = x^2$ and $y = 9x$ about the y-axis.
13. Find the volume of the solid generated by revolving the region bounded by $y = 3x^2$ and $y = 6x$ about the line $y = 12$.
14. Compute $\int_1^\infty xe^{-3x} \, dx$.
15. Compute $\int_0^1 \dfrac{4\ln(x^2)}{x} \, dx$.
16. Compute $\displaystyle\sum_{n=1}^{\infty} \left(\dfrac{3}{2^n} + \dfrac{-1}{5^n} \right)$.
17. Each time a ball is dropped from a height of h feet, it will rebound to a height of $0.3h$. Find the total distance traveled by a ball dropped from a height of 10 meters.

Answers:

1. $\dfrac{1}{56}(4x^2 + 3)^7 + C$

2. 9.62 minutes

3. $\dfrac{-3}{5}\ln|\cos(5x)| + C$

4. $2x\ln x - 2x + C$

5. 3π

6. 486.96mg; 16,086 years

7. 7.80 more minutes

8. $y(t) = 10t - 3$

9. 54 pounds

10. $y = Ce^{-4/x} - 5/2$

11. $256/3$

12. 3435.33

13. 180.96

14. $\dfrac{4}{9e^3}$

15. DNE

16. $11/4$

17. $130/7$