1. \( \frac{1}{\pi/2} \int_{0}^{\pi/2} \cos x \, dx = \frac{2}{\pi} \sin x \bigg|_{0}^{\pi/2} = \frac{2}{\pi} \).

2. \( \frac{1}{4-1} \int_{1}^{4} x^{1/2} \, dx = \frac{2}{9} x^{3/2} \bigg|_{1}^{4} = \frac{14}{9} \).

3. \( \frac{1}{5-0} \int_{0}^{5} te^{-t^2} \, dt = -\frac{1}{10} e^{-t^2} \bigg|_{0}^{5} = \frac{1}{10}(1 - e^{-25}) \).

4. \( \frac{1}{6-1} \int_{1}^{6} \frac{3}{(1+r)^2} \, dr = -\frac{3}{5(1+r)} \bigg|_{1}^{6} = -\frac{3}{35} + \frac{3}{10} = \frac{3}{14} \).

5. (a) \( \frac{1}{2} \int_{0}^{2} (4 - x^2) \, dx = 2x - \frac{1}{6} x^3 \bigg|_{0}^{2} = \frac{8}{3} \).
   
   (b) \( 4 - x^2 = \frac{8}{3} \) implies that \( x^2 = \frac{4}{3} \), so \( x = \frac{2}{\sqrt{3}} \).
   
   (c) See below.

6. (a) \( \frac{1}{2} \int_{1}^{3} \ln x \, dx = \frac{1}{2} (x \ln x - x) \bigg|_{1}^{3} = \frac{1}{2} (3 \ln 3 - 3 - (-1)) = \frac{3}{2} \ln 3 - 1 \).
   
   (b) \( \ln x = \frac{3}{2} \ln 3 - 1 \) implies that \( x = e^{-13/2} \).
   
   (c) See below.

9. The average value of \( f \) is 4, so by the Mean Value Theorem for Integrals, there is a \( c \in [a, b] \) such that \( f(c) = 4 \).

10. \( \frac{1}{b} \int_{0}^{b} 2 + 6x - 3x^2 \, dx = \frac{1}{b} (2x + 3x^2 - x^3) \bigg|_{0}^{b} = 2 + 3b - b^2 \). We want to know when this is equal to 3.

   We get \( b^2 - 3b + 1 = 0 \), so \( b = \frac{3 \pm \sqrt{5}}{2} \). Since both roots are positive, both are possible legitimate values of \( b \).

12. (a) The area under the curve is about 25.5(2)(10) = 510 km·s/h. The average speed is \( \frac{510}{12} = 42.5 \) km/h.
   
   (b) The two were equal at about 5s.