1. Let \( x \) be the number, then 
\[ x \cdot (x+8) = x - 12 \quad \Rightarrow \quad x^2 + 7x + 12 = 0 \quad \Rightarrow \quad (x+3)(x+4) = 0 \]
the numbers are -3 and -4.

2. \(- (1/4) \log_2 \left( \frac{1}{4} \right) = -(1/4) \cdot -2 = 1/2\).

3. Assume that each container holds 60 ounces. Then the first container would hold 48 ounces of vinegar, the second would hold 45 ounces of vinegar and the third would hold 40 ounces of vinegar. The total mixture of 180 ounces would therefore be 133 ounces of vinegar and 47 ounces of oil, so the ratio would be 133:47.

4. Since \( \cos x = \frac{3}{7} \) and \( \tan x < 0 \), \( x \) is in quadrant IV. By the Pythagorean Theorem
\[ y = \pm \sqrt{40} = \pm 2\sqrt{10} \quad . \space \text{Since \( y \) must be negative,} \quad y = -2\sqrt{10} \quad \text{and} \quad \sin x = -2\sqrt{10}/7 \quad . \]

5. Adding the second and third equation we obtain
\[(k+1)x + (k+1)y = 5 \quad \Rightarrow \quad x + y = 5/(k+1), \quad \text{but} \quad x + y = 1, \quad \text{so} \quad 1 = 5/(k+1) \quad \Rightarrow \quad k + 1 = 5 \quad \text{and} \quad k = 4 \quad . \]

6. Let \( PR \) be one-fourth of the length of the string, then after one revolution \( R \) is 3 inches directly above \( P \). Opening up the cylinder to obtain a rectangle and using the Pythagorean Theorem we have \( PR = \sqrt{9+16\pi^2} \quad \text{and} \quad PQ = 4\sqrt{9+16\pi^2} \).

7. There are \( 6! = 720 \) ways to arrange the cards in your hand. Of these, \( 2 \cdot 5 \cdot 4! = 240 \) arrangements have the two 5’s together. So the probability is \( 240/720 = 1/3 \).

8. Let \( x \) be the number of days it rained in the morning, \( y \) be the number of days that it rained in the afternoon, and \( z \) be the number of days that it did not rain at all. Then \( x + y = 9, \quad x + z = 6 \) and \( y + z = 7 \). Subtracting the second equation from the first yields \( y - z = 3 \). Adding the result to the third equation gives \( 2y = 10 \quad \Rightarrow \quad y = 5 \). It follows that \( x = 4 \), \( z = 2 \) and the period was 11 days.

9. Let \( x = y + a \space \text{so} \space 27 = (y + a)^2 - y^2 = 2ay + a^2 = a(2y + a) \). Hence \( a = 1, 3, 9 \) or 27 since \( a \) divides 27. If \( a = 1 \) then \( y = 13 \) and \( x = 14 \). If \( a = 3 \) then \( y = 3 \) and \( x = 6 \). These are the only two solutions since the values \( a = 9 \) and \( a = 27 \) do not yield positive integer solutions.

10. Joining the center of the circumcircle to two adjacent vertices forms an equilateral triangle. Let the radius of the circumcircle be 2, then using the Pythagorean Theorem we find that the altitude of this triangle is \( \sqrt{3} \). Since the altitude of the triangle is the radius of the inscribed circle, the ratio of the areas of the two circles is \( 4\pi : 3\pi \) or 4:3.