1. $-105\sqrt{3} + 19016 \quad A \ -105\sqrt{3} \quad \frac{7!}{4!3!}x^4\left(-\sqrt{3}\right)^3$

$B \ 8 \quad 3 + \sqrt{3x+1} = x \ , \ move \ the \ 3 \ over, \ square \ both \ sides \ gives \ 3x + 1 = x^2 - 6x + 9 \ , \ solving \ gives \ \{1,8\} \ reject \ the \ 1$

$C \ 19008 \ To \ find \ how \ many \ numbers \ are \ in \ the \ sequence, \ \ 275 = 13 + (n-1)2, \ n = 132.$

To find the sum, $S_{132} = \frac{132}{2}(13 + 275); S_{132=19008}$

$A + B + C = -105\sqrt{3} + 19016$

2. $11xy \quad A \ \frac{1}{2}$

After substituting $\frac{x+1}{x-1}$ for $x$ in the other expression we have

$\frac{x+1}{x-1} + 1 = \frac{x+1+x-1}{x-1} = \frac{2x}{2} = x,$

$\frac{x+1}{x-1} - 1 = \frac{x+1-x+1}{x-1} = \frac{2x}{2} = x,$

substituting $\frac{1}{2}$ for $x$ gives $\frac{1}{2}$

$B \ 11 \ Substituting \ the \ coordinates \ in \ the \ equation \ for \ x \ and \ y, \ we \ get \ the \ two \ equations \ a - b = 1 \ and \ -5a + b = -25.$

Solving this system gives $a = 6 \ and \ b = 5.$

The sum of $a + b = 11.$

$C \ 2xy \quad \frac{x^3 \cdot 2y^2}{y x^2} = 2xy$

$A \cdot B \cdot C = \frac{1}{2} \cdot 11 \cdot 2xy = 11xy.$

3. $\frac{1}{16} \quad A \ \frac{15}{16}$

The probability of at least one head is the probability of all not tails.

Prob of all not tails is $1 - P(\text{all tails}) = 1 - \frac{1}{16} = \frac{15}{16}$

$B \ 35 \ \gamma C_3 = 35$

$C \ \frac{7}{3} \ P(\text{no rain}) = \frac{7}{10} \ so \ odds \ of \ no \ rain \ is \ \frac{7}{3}$

$\frac{A \cdot C}{B} = \frac{\frac{7}{3} \cdot 15}{35} = \frac{1}{16}$
**4. \( \frac{9}{2} \)**

**A** \( \frac{x}{x + 6} + \frac{2x + 3}{2x^2 + 12x} = \frac{1}{x - 1} \), Multiply each term in the equation by \( 2x(x + 6)(x - 1) \).

This gives the equation \( 2x^2(x - 1) + (2x + 3)(x - 1) = 2x(x + 6) \). Solve this and find the solutions are \( 3, \frac{-2 \pm \sqrt{2}}{2} \). The sum of these is 1.

**B** \( \frac{9}{2} \)

Let \( u = \frac{1}{x} \) and \( v = \frac{1}{y} \). Substitute and this gives the system

\[
\begin{align*}
\frac{u}{4} + \frac{7v}{2} &= \frac{5}{4} \\
\frac{u}{2} - 3v &= -\frac{5}{14}
\end{align*}
\]

Solving this system gives \( v = \frac{2}{7}, u = 1 \). So \( x = 1, y = \frac{7}{2} \), sum is \( \frac{9}{2} \).

\( A \cdot B = 1 \cdot \frac{9}{2} = \frac{9}{2} \).

**5. 61**

**A** \( 1 \left( \log(5 \log(100)) \right)^2 = (\log(5 \cdot 2))^2 = 1 \)

**B** \( 25 \)

\( 9^{\log_{10}5} = 3^{2 \log_{10}5} = 3^{\log_{10}25} = 25 \)

**C** \( 4 \)

\( 256^{0.16} \cdot 256^{0.09} = 256^{\frac{1}{4}} = 4 \)

**D** \( 144 \)

\( \frac{x^2}{4} = 12, x = 144 \)

\( \frac{D}{2} \cdot AB = \frac{144}{4} + 1 \cdot 25 = 36 + 25 = 61 \)
6. \( \frac{2 - \sqrt{3}}{344} \)  \( R \)  \( 2 - \sqrt{3} \)  Using the diagram, \( AD = \frac{1}{2}\sqrt{3} \) which makes \( DC = 1 - \frac{1}{2}\sqrt{3} \) and \( BD = \frac{1}{2} \).

Use the Pythagorean Theorem in triangle BCD. This gives

\[
\left(\frac{1}{2}\right)^2 + \left(1 - \frac{1}{2}\sqrt{3}\right)^2 = x^2.
\]

\[
x^2 = 2 - \sqrt{3}
\]

7. \( \frac{\pi}{2} \)  \( A \)  \( 34\pi \)  center \((3, -5)\), \( r = \sqrt{9 + 25} = \sqrt{34} \), area = \( 34\pi \)

\( B \)  \( \sqrt{13} \)  \( y = 4(x + 2)^2 + 3 \), vertex \((-2, 3)\), distance from origin is \( \sqrt{13} \)

\( C \)  \( 6 \)  For this parabola to be tangent to the x-axis, means it has only one solution so the discriminant must be 0. \( 0 = 4k^2 - 36, k = 6 \)

\[
\frac{A}{B^2 \cdot C} = \frac{34\pi}{68} = \frac{\pi}{2}
\]

8. \( 30437 \)

\( A \)  \( -42 \)  Do synthetic division with \(-5\)

\( B \)  \( 389 \)  \( S_{130} = 2 + 129 \cdot 3 = 389 \)

\( C \)  \( 30090 \)  \( 11190 = a_i + (210)(-90); = 30090 \)

\( A + B + C = 30437 \)
9. 4  
A 1  Set the two equations equal to each other since they both equal \( y \).
\[
2 - \log(x - 2) = -1 + \log_2 x; \quad x = 4, \ y = 1
\]

B 4  Solving the system,
\[
x^2 - y^2 = 1, y = 2x - 3; \quad x^2 - (2x - 3)^2 = 1; 3x^2 - 12x + 10 = 0;
\]
\[
x = \frac{6 \pm \sqrt{6}}{3}. \text{ Sum is 4.}
\]

\( AB = 4 \)

10. 84  
A 7  \( g(2x) = x + g(2x - 1); \ g(12) = 6 + g(11); \ g(12) = 6 + 1; \ g(12) = 7 \)
B 4  \( f(x) = (2x + 1); 2(3a - 10) + 1 - 5; \ a = 4 \)
C \( \frac{1}{3} \)  \( 4 = -3x + 5 \)

\[
\frac{AB}{C} = \frac{7 \cdot 4}{\frac{1}{3}} = 84
\]

11. 3360  
A 96\pi  With the sphere inscribed in the cone, the following triangle is formed. 

Where ED is the radius of the sphere so there’s a right angle EDA. Triangle ADE is similar to triangle ABC. Set up a proportion to solve for \( x \).
\[
\frac{3}{x} = \frac{4}{8}, \ x = 6. \text{ Now use } \frac{1}{3} BH \text{ to find the volume } 96\pi .
\]

B 140  Let \( m \angle OBC = m \angle ACO = x \). This makes \( m \angle OCB = 40 - x, m \angle ABO = 100 - x, \)
\[
m \angle BOC = 180 - (m \angle OCB + m \angle OBC),
\]
\[
= 180 - (40 - x + x) = 140 .
\]

C 4\pi  The side of the hexagon is 4 which makes the radius of the circumscribed circle 4. The area of the circumscribed circle is 16\pi . Drawing an equilateral triangle with vertices of the hexagon as one of the sides and drawing the radius of the inscribed circle, makes the radius \( 2\sqrt{3} \). Use the 30-60-90 rules.

\[
\frac{AB}{C} = \frac{96\pi \cdot 140}{4\pi} = 3360
\]
12. \((5, -3, 4)\)

\[
\frac{A(x^2 - 4)}{x} + \frac{B(x - 2)}{x + 2} + \frac{Cx(x + 2)}{x - 2} = \\
A(x^2 - 4A + Bx^2 - 2Bx + Cx^2 + 2Cx = 6x^2 + 14x - 20; \\
A + B + C = 6; -4A = -20, A = 5. \\
-2B + 2C = 14, -B + C = 7 and B + C = 1. \\
Solving the system makes C = 4, B = -3
\]

13. \(\frac{(a + b)^2}{ab}\) or \(\frac{a^2 + 2ab + b^2}{ab}\)

\[
\frac{1}{a} + \frac{1}{b} = \frac{b + a}{ab} = \frac{(a + b)^2}{ab} \text{ or } \frac{a^2 + 2ab + b^2}{ab}
\]

\[
\left(\frac{1}{a} + \frac{1}{b}\right)^{-1} = \frac{1}{a + b}
\]

14. \(5 - x\) or \(-x + 5\) or \(-(x-5)\)

\[
\frac{(x - 3)(x^2 + 3x + 9)}{2(3 + x)(3 - x)} \cdot \frac{10(x - 5)(x + 3)}{5(x^2 + 3x + 9)} = \frac{(x - 5)(x^2 + 3x + 9)}{2(3 + x)(3 - x)} \cdot \frac{10(x - 5)(x + 3)}{5(x^2 + 3x + 9)} = -1(x - 5) = 5 - x
\]