1. \[ \frac{15}{6} \text{ or } \frac{95}{6} \]

Part a: \(3^5 = 243\), so \(a = 5\). Part b: \(4\sqrt[3]{2} = 2^2 \cdot 2^{1/3} = 2^{7/3}\), so \(b = \frac{7}{3}\). Part c: \(7^{-3} = \frac{1}{343}\), so \(c = -3\). Part d: \(\left(\frac{1}{2}\right)^3 = \frac{1}{8}\), so \(d = 3\). Part e: \(9^x = 27 \Rightarrow x \text{ (and } e) = \frac{3}{2}\).

Part f: \(\left(\sqrt{5}\right)^x = 125\sqrt{5} \Rightarrow 5^{x/2} = 5^{7/2}\), so \(x \text{ (and } f) = 7\). Sum the parts.

2. \[ \frac{-9}{6} \text{ or } \frac{-55}{6} \]

Part A: The value of \(z\) so that \(2z + 3 = -9 \Rightarrow z = -6\). So, \(h(2 \cdot -6 + 3) = \frac{-17}{2}\).

Part B: \(h^{-1}(4) = \text{ the value of } x\) so that \(h(x) = 4\) or \(\frac{16 - 2x}{5 + x} = 4 \& x = \frac{-2}{3}\). Sum the parts.

3. \[ \frac{9 + \sqrt{15}}{2} \text{ or } 4.5 + \sqrt{15} \]

Part A: The denominator is 1 greater than the whole given expression. So, we rewrite the problem as

\[
x = 1 + \frac{8}{2 + \frac{8}{2 + \frac{8}{2 + \ldots}}} \Rightarrow x = 1 + \frac{8}{x + 1}.
\]

Solving this gives \(x = 3\).

Part B: The 1st denom. is not the same as our expression, but the 2nd one is. So, we rewrite it as

\[
x = 3 + \frac{1}{2 + \frac{1}{3 + \frac{1}{2 + \ldots}}} = 3 + \frac{1}{2 + \frac{1}{x}}.
\]

This simplifies to a quadratic and using the formula, we get \(x = \frac{3 + \sqrt{15}}{2}\). The answer must be positive. Sum the parts.

4. \[ \frac{21}{2} \text{ or } \frac{43}{2} \]

Part A: Squaring both sides, we get

\[
4x + 1 - 2\sqrt{(4x + 1)(x - 11)} + x - 11 = 2x - 4 \text{ or } 3x - 6 = 2\sqrt{4x^2 - 43x - 11}.
\]

Squaring again gives: \(9x^2 - 36x + 36 = 16x^2 - 172x - 44 \Rightarrow 7x^2 - 136x - 80 = 0\). This factors to: \((x - 20)(7x + 4) = 0\). The only solution that works is \(x = 20\). Part B: Cubing both sides, we get \(x^3 - x^2 - 10 = (x - 1)^3 = x^3 - 3x^2 + 3x - 1 \Rightarrow 2x^2 - 3x - 9 = 0\). Factoring gives the solutions \(x = 3\) and \(x = \frac{-3}{2}\). Sum all the solutions.
5. \[1133\] Part A: All of the parentheses subtract to 2. But, how many? So, we rewrite the problem:
\[1000 + (-998 + 998) + (-996 + 996) + (-994 + 994) + \ldots + (-334 + 334) - 332\]
\[= 1000 - 332 = 668.\]
Part B: All of the numbers are perfect squares. Rewrite as
\[30^2 - 29^2 + 28^2 - 27^2 + \ldots + 4^2 - 3^2 + 2^2 - 1^2 =\]
\[(30^2 - 29^2) + (28^2 - 27^2) + \ldots + (4^2 - 3^2) + (2^2 - 1^2) = 59 + 55 + \ldots + 7 + 3.\]
This is an arithmetic series and the sum is 465. Sum the parts to get the final answer.

6. \[65,520\] M: This simplifies to \[3^{2^{3^2}} = 3^{2^{16}} = 3^{65536}.\]
D: This simplifies to
\[\left(\left((3^2)^2\right)^2\right)^2 = \left((3^4)^2\right)^2 = \left((3^8)^2\right) = 3^{16}.\]
So, \[\frac{M}{D} = \frac{3^{65536}}{3^{16}} = 3^{65520},\] and \[P = 65520.\]

7. \[165\] Part A: 99% of the 200 fish = 198 guppies. If you remove 100 guppies, then the remainder is 98 out of 100 total fish or 98%. Part B: Just figure out the times and you will determine that 8:57 is the time. Add the minutes and hour to get 65, then add the parts to get the final answer.

8. \[1073\] Part A: Because the mean and mode are equal, one of the numbers must be repeated, and \(x\) must be 40 or 50. If \(x\) were 30 or 80, then the median and mode would not be equal. Checking the mean will show that 50 is the correct answer. Part B: Eliminating exponents, the series becomes: \[1 + 2 + 4 + \ldots + 512,\] which are the first 9 powers of 2. This sum formula for powers of 2 is \(2^{n+1} - 1\) \(\Rightarrow 2^{10} - 1 = 1023.\) Sum the parts to get the final answer.

9. \[13\] Part A: The # of chapters done is directly proportional to the number of people, and directly proportional to the amount of time spent. So, \[\frac{\text{(of ppl)(amt. of time)}}{\# \text{ of chapters}} = k.\]
Plugging in that I can do the problems in 1 chapter alone in 8 hours, we get \(k = 8.\) So, if \(n\) people can do 30 chapters in 24 hours, and plugging in to the equation, we get \(n = 10.\) Part B: Each good worker can paint 1/12 of my house in an hour, so 3 together can paint 3/12 = \(\frac{1}{4}\) of my house. So, in 3 hours, they paint \(\frac{3}{4}\) of my house. The bad workers have to paint the other \(\frac{1}{4}.\) Each bad worker paints 1/36 of my house in an hour, so in 3 hours each bad worker can paint 1/12 of my house. So, I need \((1/4)(1/12) = 3\) bad workers. Sum the parts.

10. \(8 \frac{1}{2}\) or \(\frac{17}{2}\) Part A: Clearing fractions gives the equation \(2x^2 + 11x + 5 = 0\) & \(x = -\frac{1}{2}, -5.\)
Their sum is \(-5.5.\) Part B: This factors as \((2x^2 - 1)(x^2 - 2)\) and \(x = \pm\sqrt{2}, \pm\frac{1}{\sqrt{2}}.\) Their sum is 0. Part C: Cross multiply to get the equation \(x^2 - 12x + 32 = 0\) and \(x = 4, 8.\) Their sum is 12. Part D: Factoring gives the equation \(\frac{(x - 8)(x - 1)}{(x - 1)} + \frac{(3x - 2)(x + 1)}{(3x - 2)} = -3\) and \(-3 = 2x - 7\) and \(x = 2.\) Sum the parts to get the answer.
11. $7 + 27i$

Part A: We get $-4 + 27i$. Part B: All sets of 4 consecutive $i$ terms will be 0, and 600 is evenly divisible by 4, hence everything adds to 0 except for the number 1 at the end. So, the sum is 1. Part C: Expanding will give $(5c + 18) + (30 - 3c)i$. Since this product must be real, then $(30 - 3c)i = 0$ and $c = 10$. Sum the parts to get the final answer.

12. $27$

Part A: Because the train is going 60mph, the front of the train moves 1 m/min. So, in the 3 minutes since the front of the train entered the tunnel, the train has moved 3 miles. At the end of those 3 minutes, the front is 1 mile past the tunnel (the train is 1 mile long and its end is just leaving the tunnel). So, the front has moved 3 miles from the beginning of the tunnel and is now 1 mile beyond the end. Hence, the tunnel is $3 - 1 = 2$ miles long. Part B: Since Superman can go all the way around the world in 2.5 hours, he can go \( \frac{1}{2.5} \) of the world in 1 hour. The same way, Flash can go around \( \frac{1}{1.5} \) of the world in 1 hour. In \( x \) hours, Superman travels \( \frac{x}{2.5} \) of the world and Flash travels \( \frac{x}{1.5} \) of the world. Their paths together make a single path all the way around the world and we get the equation \( \frac{x}{2.5} + \frac{x}{1.5} = 1 \) and \( x = \frac{15}{16} \). So, they meet for the 1st time in \( \frac{15}{16} \) of an hour and every \( \frac{15}{16} \) hours thereafter. Multiplying by 24 hours gives us 25.6 times that they will meet. Disregard the decimal to get 25 times. Sum the parts.

13. $15$

Part A: Because \( f(-3) = 2 \), we get \( 81a - 9b - 3 + 5 = 2 \Rightarrow 81a - 9b = 0 \). We also have \( f(3) = 81a - 9b + 3 + 5 = 0 + 8 = 8 \). Part B:

\( f(-4) = 41 \), and since \( f(4) \) also \( = 41 \), and we are given that \( g(f(4)) = 9 \), then \( g(41) = 9 \). Part C: Solving \( 2a - \frac{6}{a} = -4 \) gives \( a = 1, -3 \). Sum the parts.

14. $-1$

Part L: First, since the vertex is below the x-axis and the parabola crosses the x-axis, then it opens upward and \( a \) must be positive (1 choice). Part M: You must complete the square to determine the signs of \( b \) & \( c \). This gives \( y = a \left( x^2 + \frac{b}{a}x + \frac{b^2}{4a^2} \right) \). Because the vertex is (4, -5), we get \( \frac{-b}{2a} = 4 \) and since \( a \) is positive, then \( b \) must be negative (1 choice). Since the x-coordinates are on opposite sides of the y-axis, one root is positive and one root is negative. So, the product of the 2 roots is negative, which means that \( \frac{c}{a} \) must be negative and since \( a \) is positive, then \( c \) must be negative (1 choice). One positive minus 2 negatives = -1.
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