1. **B** -
2. **E** -
3. **B** - % change
4. **E** - total distance , total time = total distance / speed
5. **E** - total volume
6. **B** - rounds of wool
7. **D** - total price
8. **C** - abscissa = values of x, adding up the equations yields 12 is the only positive value
9. **C** - Age of Yasmine = y, Age of Cheyenne = c, Age of Jack = j

From the question we get: Plugging in our first 2 equations into the third equation, we get:

1. **D** - slope
2. **E** - The prime numbers under 150 are: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 139, 149. There are 35 prime numbers.
3. **A** - First combine “j”, “m”, and “w” into 1 letter. The number of distinct orderings with the rest of the letters in the word and the combined letter is Now we must find the number of orderings of the letters within the combined letter So the total number of orderings of “jameswatts”
4. **D** - number of steam engines = number of crankshafts \* number of gears
5. **D** - To find minimum distance, we first reflect the end point (12, 10) across the gas location x = 5. This yields (-2, 10). We then find the distance between the reflected point and the starting point (7, 8) =
6. **B** - surface area of a sphere =
7. **B** - Since the trains are traveling in opposite directions, the two trains can essentially be represented as one train traveling at 300 mph. The trains will take to reach each other. In 2.4 hours, the slower train will travel
8. **B** - Let S(n) denote the number of ways to sum to n with only 1’s and 2’s. Split this problem into two cases: case 1 - the sum ends with a 1, case 2 - the sum ends with a 2. In case 1, we can just find S(9) and add a 1 to the end of it. In case 2, we can just find S(8) and add a 2 to the end of it. So, we get S(10) = S(9) + S(8). This recursion can be traced all the way to the base case of S(3) = S(2) + S(1). We can just manually solve S(2) and S(1) which are just 2 and 1 respectively and work our way up. We get 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, so 89 is the answer.
9. **A** - We can find the largest possible number by assuming the other 4 to be as small as possible. This is just 2, 4, 6, 8 since all of the numbers must be distinct positive integers. If the average of the set of 5 numbers is 8, then the sum is just 40. Computing gives 20.
10. **E** - Let the lengths of the edges be a, b, and c. We get the equation . The volume will be maximized when the prism is a cube so when . This can be proven with AM-GM as well. Computing to find the volume gives 512.
11. **C** - Let the sides perpendicular to the house be x. This means the side parallel to the house is 60 - 2x. We want to maximize . We can apply the vertex formula of to find the x value that maximizes the area of the plot. We get x. When x = 15, the area is just .
12. **D** - The probability of someone having the disease and testing positive is 0.02(0.98). The probability of someone not having the disease and testing positive is 0.98(0.02). So, the probability of someone actually having the disease when testing positive is just 0.50.
13. **D** -
14. **C** - First pick 3 random digits from the 10 possible digits. The smallest one picked will be Z and the other two digits can be either E or $. This is just .
15. **A** - Let the roots of the quadratic be p and q. Use Vieta’s to get and . Multiply by 3 to get . Equate through the 3a to get . Rewrite this as . Since p and q are integers, we can just manually check solutions to get (0, 0), (-6, 2), (6, 6), (12, 4). The order of p and q doesn’t matter since we only want to solve for a and . The four ordered pairs give . Computing .
16. **E** - Working backwards, there are 3 remaining on the 29th and 9 remaining on the 28th, which isn’t an answer choice.
17. **C** - As long as y is even, x will have a solution. Given the restrictions in the question, y can be any even number from 2 to 32 inclusive. This gives 16 ordered pairs.
18. **C** - Use the Euclidean Algorithm.

The two smallest positive values of x that make simplifiable are 6 and 13. .

1. **C** - Add all the equations to get

Subtract each equation from this new equation to get .

Multiply these three new equations to get (since a, b, and c are positive).

Divide the ab, bc, and ca equations to get . .

1. **D** - Square both sides of to get .

Multiply .

Multiply .

1. **B** - There are total diagonals in a decagon. There are ways to choose two of them. Now we need to find how many of these pairs intersect strictly in the interior of the decagon. If we choose any 4 vertices of the decagon, it will determine one unique pair of diagonals that satisfy these conditions exactly. So, solving , we get 210. Simplifying , we get .