1. D

$$5N + 25Q = 320$$
$$N + Q = 28$$
$$N = 9, Q = 19, N * Q = 171$$

2. A Orange marbles = $26 - 9 - 4 - 5 = 8$. $\frac{{}_8C_2}{{}_{26}C_2} = \frac{28}{325}$

3. D Fence left after one hour: $\frac{11}{12}$. Pedro and Juan's rate: $\frac{1}{12} + \frac{1}{8} = \frac{5}{24}$.
Fence left after three hours: $\frac{11}{12} - \frac{10}{24} = \frac{12}{24} = \frac{1}{2}$. Pedro, Juan, and Paul's rate: $\frac{1}{12} + \frac{1}{8} + \frac{1}{6} = \frac{9}{24}$. After Paul joins, the fence is completed in $\frac{1}{2} \div \frac{9}{24} = \frac{12}{9} = \frac{4}{3}$ hours. Total time $= \frac{4}{3} + 3 = \frac{13}{3}$

4. A Galen completes the race in $400 \div 4 = 100$ seconds. Mo runs $100 * 5 = 500$ meters in that time. $500 - 400 = 100$

5. C

$$F + V = E + 2$$
$$F = 20, V = 30, \text{so } E = 48$$

6. B Reflect $(6, 9)$ across the line $y = x$ to get $(9, 6)$. Distance formula between $(-2, 5)$ and $(9, 6)$ gives you $\sqrt{122}$

7. B Probability that Caleb wins $= \frac{2}{3} * \frac{2}{3} * \frac{1}{3} + \left(\frac{2}{3} * \frac{2}{3} * \frac{2}{3} * \frac{2}{3}\right) * \frac{2}{3} * \frac{2}{3} * \frac{1}{3} + \cdots = \frac{4}{27} + \left(\frac{16}{81}\right) * \frac{4}{27} + \cdots = \frac{\frac{4}{27}}{1 - \frac{16}{81}} = \frac{12}{65}$

8. B $$A = P\left(1 + \frac{r}{n}\right)^{nt} = 100{,}000(1 + \frac{0.3}{3})^{3*1} = 100{,}000(1.1)^3 = 133{,}100$$

9. D

$$Area = x(400 - 2x) = 400x - 2x^2;\ -\frac{b}{2a} = 100; 100 * 200 = 200{,}00$$

10. B

$$100 + 2\left(\frac{10}{1-\frac{1}{10}}\right) = 100 + \frac{200}{9} = \frac{1100}{9}$$

11. E

$$revenue = (10+x)(38{,}000 - 1500x) = 380{,}000 + 23{,}000x - 1500x^2;\ -\frac{b}{2a}$$
$$= \frac{-23{,}000}{-3000} \approx 8; 10 + 8 = 18$$

12. A Take the conjugates of the imaginary roots and include them in the polynomial.

$$(x-1)(x-2+i)(x-2-i)(x-1+3i)(x-1-3i)$$
$$= x^5 - 7x^4 + 29x^3 - 73x^2 + 100x - 50$$

13. B

Concentration	Amount	Total
2/5	5	2
1	x	x
4/5	5+x	2+x

$$\frac{4}{5}(5+x) = 2 + x; x = 10$$

Concentration	Amount	Total
4/5	15	12
1/2	y	12+y/2
3/5	15+y	24+y/2

$$\frac{3}{5}(15+y) = 24 + \frac{y}{2}; y = 30$$

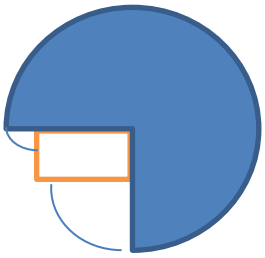
14. D Distance from point to line formula

$$\frac{|Aa + Bb - C|}{\sqrt{a^2 + b^2}} = \frac{|-93|}{10} = \frac{93}{10}$$

15. D

$$100 + {}_{100}C_2 - 20 * {}_5C_2 = 4850$$

16. C



$$625\pi * \frac{3}{4} + 25\pi * \frac{1}{4} + 225\pi * \frac{1}{4} = \frac{2125\pi}{4}$$

17. A $Score = \alpha * \frac{Studying * \sqrt{Sleep}}{DND};\ 60 = \alpha * \frac{2 * \sqrt{4}}{8};\ \alpha = 120; 120 * \frac{1 * \sqrt{9}}{4} = 90$

18. B Usain: 200m in 20 seconds.
Justin: 180m in 20 seconds $\frac{180}{20} = \frac{200}{x}; x = \frac{200}{9}$. It takes Justin $\frac{200}{9}$ seconds to travel 200m.

Justin: 200m in 200/9 seconds
Andre: 185m in 200/9 seconds. $\frac{185}{\frac{200}{9}} = \frac{y}{20}; y = 166.5$; Andre travels 166.5m in 20 seconds. Usain travels 200m in 20 seconds. $200 - 166.5 = 33.5$

19. D $55 * 55 = 3025; 50 * 20 = 1000;\ \frac{10000 - 3025}{1000} = \frac{279}{40}$

20. A $x^6 - 5x^5 - 36x^4 + 170x^3 - 91x^2 - 165x + 126$
$= (x-1)^2(x+1)(x-3)(x-7)(x+6);\ 1^3 + 3^3 + (-1)^3 + 7^3 + (-6)^3 = 154$

21. C $\left|25 - \left|6 + |8 - x|\right|\right| < 13;$
Case 1: $25 - \left|6 + |8 - x|\right| < 13;\ \left|6 + |8 - x|\right| > 12$
Case 1a: $6 + |8 - x| > 12;\ |8 - x| > 6; x < 2, x > 14$
Case 1b: $6 + |8 - x| < -12;\ \emptyset$
Case 2: $25 - \left|6 + |8 - x|\right| > -13;\ \left|6 + |8 - x|\right| < 38$
Case 2a: $6 + |8 - x| < 38;\ |8 - x| < 32; -24 < x,\ x < 40$
Case 2b: $6 + |8 - x| > -38$; All real numbers satisfy this.

Constraints: $x < 2, x > 14, -24 < x,\ x < 40$
Intervals: $-24 < x < 2, 14 < x < 40$. 50 integers satisfy the equation.

22. D $q^2 = 12; q = \pm 2\sqrt{3}; p = -2q = \pm 4\sqrt{3}; p > 0 \rightarrow p = 4\sqrt{3}; q = -2\sqrt{3}; pq + p + q$
$= -24 + 2\sqrt{3}$

23. B (Number of cases where Albert and Ben are next to each other) – (number of cases where Caroline and Emily are next to each other, and Albert and Ben are next to each other).
$$4! * 2 - 3! * 2 * 2 = 24$$

24. B Since half the number of cows have 4 legs and the other half have 5 legs, the average number of legs each cow has is 4.5
$x =$cow, $y =$chicken
$$x + y = 72$$

$$4.5x + 2y = 249$$
$$x = 42, y = 30; 30 - 21 = 9$$

25. C The resulting shape is 2 cones facing the opposite directions with a cylinder separating them. The cones have height $\frac{7}{2}$ and radius 12, while the cylinder has height 9 and radius 12.

$$Volume = \pi r^2 h_{cylinder} + 2 * \frac{1}{3}\pi r^2 h_{cone} = 1632\pi$$

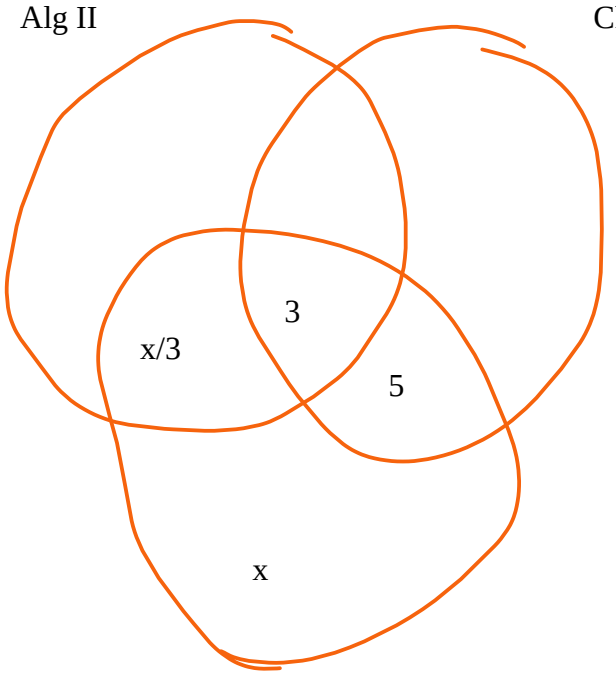
26. A 3 half life cycles for 32.1 seconds. $\frac{32.1}{3} = 10.7$

27. D Time it takes for package to fall = $\frac{10{,}000}{128}$. Horizontal distance = horizontal velocity * time = $10{,}000 * 800 \div 128 = 62{,}500$.

28. A (Number of ways you can choose 3 points) – (Number of degenerate triangles).

$$_{18}C_3 - {}_4C_3 - {}_5C_3 - {}_6C_3 - {}_7C_3 = 747$$

29. E



$$x + \frac{x}{3} + 3 + 5 = 32; x = 18$$
Algebra II+Chem = $54 + 32 - 9 = 77$
Chem only = $99 - 77 = 22$

30. A Let p be the total number of points the students scored originally and let n be the number of students originally in her fourth period. Thus, $76 = \frac{p}{n}$. However, with the addition of Albert, $82 = \frac{p+100}{n+1}$. Solving the system of equations, we get $n = 3$.