1. There are 25 prime numbers less than 100. **B**

2. $\frac{(x^2-3x-18)(\sqrt{x+1}-3)(x+10+6\sqrt{x+1})(\sqrt{x+1}-3)}{(x^2-5x-24)(\sqrt{x+1}+3)(\sqrt{x+1}-3)} = \frac{(x-6)(x+3)(x+10-6\sqrt{x+1})(x+10+6\sqrt{x+1})}{(x^2-5x-24)(x-8)} =$
$\frac{(x-6)(x+3)(x^2+20x+100-36(x+1))}{(x^2-5x-24)(x-8)} = \frac{(x-6)(x+3)(x^2-16x+64)}{(x^2-5x-24)(x-8)} = (x-6)$ **D**

3. The centers of the conics are $(1,-1)$ and $(3\ ,3)$. The slope through these two points is $\left(\frac{4}{2}\right) = 2$. The perpendicular bisector has the negative reciprocal of the slope and has value $-\frac{1}{2}$. The midpoint between the two points is $(2, 1)$. Using this information, we can solve for the equation of the line. $x - 2 + 2(y-1) = 0.$ $x + 2y = 4.$ **D**

4. Using synthetic division, we can plug in $x = -1$ to find the remainder to be 0. **A**

-1	1	0	0	…	0	0	1	1	1
		-1	1	…	-1	1	-1	0	-1
	1	-1	1	…	-1	1	0	1	0

5. 1008 factors into $7 * 2^4 * 3^2$. We can choose to have 0 or 1 multiples of 7; 0, 1, 2, 3, or 4 multiples of 2; and 0, 1, or 2 multiples of 3. Thus, there are 2*5*3 positive integral factors of 1008. 30 **A**

6. Looking at the minute hand, the angle between the minute hand and the vertical line is $360° * \frac{7}{60} = 7 * 6° = 42°$. The angle between the hour hand and the vertical line is $30° + 30°\left(\frac{37}{60}\right) = 30° + 18.5° = 48.5°$. The difference between these two angles is $6.5°$. **C**

7. You can use: (1Q, 1P), (2D, 1N, 1P), (2D, 6P), (1D, 3N, 1P), (1D, 2N, 6P), (1D, 1N, 11P), (1D, 16P), (5N, 1P), (4N, 6P), (3N, 11P), (2N, 16P), (1N, 21P), (26P). 13 **C**

8. $381^2 - 2 * 3 * 127 * 281 + 281^2 = (381 - 281)^2 = 10000$. **A**

9. Out of 36 possibilities for sums, 6 of them result in sums greater than or equal to 14. 1/6 **B**

	3	4	5	6	7	8
3	6	7	8	9	10	11
4	7	8	9	10	11	12
5	8	9	10	11	12	13
6	9	10	11	12	13	14
7	10	11	12	13	14	15
8	11	12	13	14	15	16

10. The complement is the probability that you didn't choose the rotten apple.
$\text{P(no rotton apple)} = \frac{4C3}{5C3} = \frac{2}{5}$. Thus, there is a $\frac{3}{5}$ probability that you chose the rotten apple. **C**

11. $\frac{9!}{3!} = 60{,}480$. **A**

12. $\begin{vmatrix} 2 & 3 & 1 & 2 \\ -4 & 8 & -2 & 6 \\ -2 & 7 & 1 & 1 \\ 0 & 3 & -1 & 2 \end{vmatrix} = \begin{vmatrix} 2 & 3 & 1 & 2 \\ 0 & 14 & 0 & 10 \\ 0 & 10 & 2 & 3 \\ 0 & 3 & -1 & 2 \end{vmatrix} = 2\begin{vmatrix} 14 & 0 & 10 \\ 10 & 2 & 3 \\ 3 & -1 & 2 \end{vmatrix} = 2\begin{vmatrix} 14 & 0 & 10 \\ 16 & 0 & 7 \\ 3 & -1 & 2 \end{vmatrix} =$
$2\begin{vmatrix} 14 & 10 \\ 16 & 7 \end{vmatrix} = 2(98-160) = 2(-62) = -124.$ **E**

13. The maximum area is created when the length is equal to the circumference of a circle. $4e = 2\pi r.\ r = \frac{2e}{\pi}$. Area $= \pi r^2 = \pi\left(\frac{2e}{\pi}\right)^2 = \frac{4e^2}{\pi}$ **E**

14. $2(\log_{25} 9)\left(\log_{81}\sqrt{5}\right) = \frac{\log 3}{\log 5}\left(\frac{\log 5}{\log 81}\right) = \frac{1}{4}$. **B**

15. (10,10,1), (10, 9, 2), (10, 8, 3), (10, 7, 4), (10, 6, 5), (9, 9, 3), (9, 8, 4), (9, 7, 5), (9, 6, 6), (8, 8, 5), (8, 7, 6), (7, 7, 7). There are 12 combinations. **B**

16. After 9 days, the slug climbs 45 feet. On the 10th day, the slug surpasses 50 feet. **C**

17. Because $\overline{BE} = \overline{FC}$, we know that their intercepted arcs are the same. $\widehat{CDE} = \widehat{BAF}, \widehat{CDE} - \widehat{CB} = \widehat{BAF} - \widehat{CB}.\ \widehat{CE} = \widehat{BF} = 38(2) = 76. \angle CGE = 76.$ Since $\angle BGC$ is supplementary to $\angle CGE$, we know that $\angle BGC = 104$. **B**

18. Since no three points are collinear, we can assume that any combination of 3 points will yield a triangle. $\binom{20}{3} = 20 * 19 * \frac{18}{6} = 20 * 19 * 3 = 1140.$ **B**

19. The dimensions of the rectangular prism is 12 by $6\sqrt{3}$ by $4\sqrt{6}$. $Volume = lwh = 864\sqrt{2}$. **A**

20. The largest volume occurs when the volume is in the shape of a sphere. $40 = 4\pi r^2. r = \sqrt{\frac{10}{\pi}}. V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi\left(\frac{10}{\pi}\right)\sqrt{\frac{10}{\pi}} = \frac{40\sqrt{10\pi}}{3\pi}$. **D**

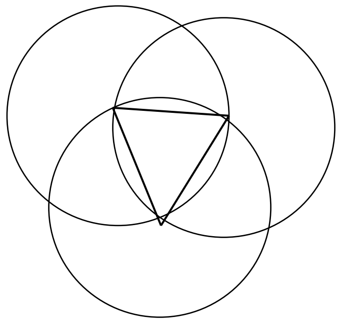
21. 6 days(12 hours/day)(1/2)(4 pieces/hour)=144 pieces. **A**

22. $\frac{3}{4}x + \frac{100-x}{8} = 25.\ 6x + 100 - x = 200.\ 5x = 100.\ x = 20.$ **C**

% Ice	Amount (mL)	Total=ConcentrationXAmount (mL)
75	x	$\frac{3}{4}x$
12.5	$100-x$	$\frac{100-x}{8}$
25	100	25

23. The area of the intersection of all three circles can be solved for by drawing an equilateral triangle by connecting the centers of all three circles. The area of the region bounded by any circle and a side of the triangle can be solved for by subtracting out the area of the triangle from a 60 degree sector of the circle. $6^2\pi\left(\frac{60}{360}\right) - \frac{6^2\sqrt{3}}{4} = 6\pi - 9\sqrt{3}$. The area of intersection is found

by adding twice this bounded area to a 60 degree sector of the circle. $6\pi + 2\left(6\pi - 9\sqrt{3}\right) = 18\pi - 18\sqrt{3}$. **A**



24. The overlapping area of any two circles is found by subtracting out a triangle with sides of length 6, 6, and $6\sqrt{3}$ from a 120 degree sector of a circle. $2\left(12\pi - 18\sqrt{3}\right) = 24\pi - 36\sqrt{3}$. The area of intersection of any two or more circles is three times the area of the intersection between two circles minus two times the intersection of all three circles (this accounts for triple counted areas). $3\left(24\pi - 36\sqrt{3}\right) - 2\left(18\pi - 18\sqrt{3}\right) = 36\pi - 72\sqrt{3}$. **B**

25. $[(i+1)^2 - 2i - 1]^{\frac{23}{2}} = [(i+1-1)^2]^{\frac{23}{2}} = i^{23} = i^3 = -i$. **D**

26. $\frac{1}{2}, \frac{3}{4} . \frac{7}{8}, \frac{15}{16}, \frac{31}{32}, \ldots = 1 - \frac{1}{2} + 1 - \frac{1}{4} + 1 - \frac{1}{8} + \cdots$. The first n terms sum to $1(n) - \frac{\left(\frac{1}{2}\right)\left(1 - \left(\frac{1}{2}\right)^n\right)}{\frac{1}{2}} = 10 - (1 - .5^{10}) = \frac{9217}{1024}$. **B**

27. $y = \frac{x^3 + x^2 + 6x - 8}{x^3 + 3x^2 - x - 3} = y = \frac{(x^2 + 2x + 8)(x-1)}{(x+1)(x-1)(x+3)}$. $(x-1)$ corresponds to a hole in the graph. $x = -1$ and $x = -3$ are the vertical asymptotes and $y = 1$ is the horizontal asymptote. **A**

28. $\frac{x}{2} = 45$. $x = 90\text{mph}$. **C**

Rate (mph)	Time (Hr)	Distance (miles)
100	$\frac{2}{5}$	40
50	$\frac{1}{10}$	5
x	$\frac{1}{2}$	45

29. $9x^2 + 12xi - 6 = \left(3x + 2i + \sqrt{2}\right)\left(3x + 2i - \sqrt{2}\right)$. **E**

30. The diameter of the circle is equal to $8 + 8\sqrt{2}$. Thus, the radius of the circle is $4 + 4\sqrt{2}$ and the area of the circle is equal to $\left(48 + 32\sqrt{2}\right)\pi$. **A**