1.

$$2x = 14$$
$$x = 7\ (C)$$

2. There are 365 days in a year. The shrub grows $\frac{6}{12} = \frac{1}{2}$ feet per year. Thus, it will grow $\frac{1}{2} * \frac{365}{5} = \frac{365}{10} = 36.5\ (B)$ feet in one year.

3. $\frac{1}{20} \times 400 = 20\ (D)$

4. Apples are 2 dollars each. Pears are 4 dollars each. A watermelon is 5 dollars. Thus, we have $10 * 2 + 4 \times 3 + 2 \times 5 = 42$ dollars. $(E)$.

5. $\frac{10}{100} = \frac{500}{x} \implies x = 10 * 500 = 5000\text{m}^3\ (D)$

6. The formula for the sum of the first $n$ odd integers is $n^2$. $225 = 15^2$, so it will take Thomas $15\ (E)$ days to finish reading the book.

7. We have that 1 cow produces 3 gallons of milk each day. Thus, in a week, 1 cow would produce 21 gallons of milk. Therefore, we need $10\ (C)$ cows to produce 210 gallons of milk in a week.

8. The laser pointer's movement creates a 30-60-90 triangle with the wall. The smaller leg of this triangle has length 8. Therefore, the longer leg, which we must find, has length $8\sqrt{3}\ (C)$.

9. $\angle CAJ = \angle CAB + \angle BAJ$. Note that $\angle CAB$ is 45 degrees. Notice that $\triangle BAJ$ is isosceles. Because $\angle ABJ$ is one of the interior angles of a hexagon, we know that it has measure 120. Therefore, the two base angles of the isosceles triangle must have measure $\frac{180-120}{2} = 30$ degrees. Thus, the answer is $45 + 30 = 75\ (C)$.

10. Let $x$ be the number of adult tickets. Let $y$ be the number of children tickets.

$$2x + 1.5y = 850 \tag{1}$$
$$x + y = 500 \tag{2}$$

Multiplying the second would make it

$$2x + 2y = 1000 \tag{3}$$

Subtracting the very first equation from this one gives $0.5y = 150 \implies y = 300$. Thus, there are $500 - 300 = 200\ (B)$

11. The volume of a sphere is proportional to the cube of its radius.

$$\left(\frac{r}{3r}\right)^3 = \frac{V_1}{V_2} \tag{4}$$
$$\frac{r^3}{27r^3} = \frac{V_1}{V_2} \tag{5}$$
$$\frac{1}{27} = \frac{V_1}{V_2} \tag{6}$$

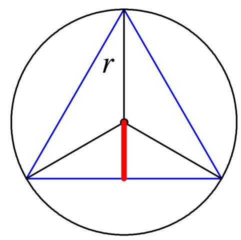
Thus, the volume of the sphere if the radius is tripled is 27 times as large as the original sphere. Therefore, the volume increases by 2600 percent $(D)$.

12. $x = \sqrt{7}, -\sqrt{7}$. The sum of these two is $0\ (C)$.

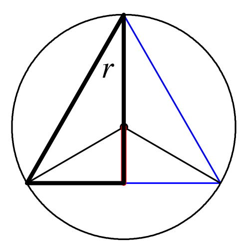
13. Remember that speed = distance ÷ time
The speed of the plane leaving from Án is $\frac{500}{t}$. The speed of the plane leaving from Wīng is $\frac{650}{t}$. The ratio of these two is $\frac{\frac{500}{t}}{\frac{650}{t}}$. The two times are equal, as stated by the problem. Thus, the ratio is $\frac{10}{13}\ (C)$.

14. The circumference of a circle is given by $2\pi r$. If $r$ increases by 1, then the circumference would be $2\pi(r+1)$. Subtracting $2\pi r$ from this gives $2\pi$ $(B)$.

15. The diagonal of the square has length $2r$. Using the formula for the area of a rhombus (a square is a rhombus) which is $\frac{d_1 d_1}{2}$. The lengths of the diagonal of a square are equal. Thus, we have that the area of this square is $4r^2/2 = 2r^2$.




The every line connecting the center of a circle and a point on the circle is $r$. To find the height of the triangle we also need the length in red. Because the center of the circle is also the centroid of the triangle, the length in red is $\frac{1}{2}r$, as the centroid divides each median in a ratio of $2:1$. This can also be found by examining the smaller 30-60-90 triangle formed by this line, the radius, and the side of the triangle. Either way, the height of the triangle is $\frac{3}{2}r$. Note that this triangle is a 30-60-90 triangle:




As determined above, longer leg of this triangle (the height of the equilateral triangle) has length $\frac{3}{2}r$. Using the ratio of sides in a 30-60-90 triangle, the shorter leg must have length $\frac{3}{2\sqrt{3}r}$, meaning that the sidelength of the triangle is $\sqrt{3}r$. Using $\frac{1}{2}bh$, the area of the triangle is $\frac{1}{2} * \frac{3}{2}r * \sqrt{3}r = \frac{3\sqrt{3}}{4}r^2$. The ratio of the square to the area of this triangle is then $\frac{2r^2}{\frac{3\sqrt{3}}{4}r^2} = \frac{8}{3\sqrt{3}} = \frac{8\sqrt{3}}{9}$ $(D)$.

16. $\frac{1}{a} + \frac{1}{b} = \frac{a}{ab} + \frac{b}{ab} = \frac{a+b}{ab} = \frac{1}{4}$ $(A)$

17. $2^{68} \times 5^4 = 2^{67} \times 5^3 \times 5 \times 2 = 2^{67} \times 5^3 \times 10$. Since the entire product is multiplied by 10, it must end in 0 $(A)$ In general, any even number multiplied by 5 will end in zero. Likewise, any multiple of 5 multiplied by 2 will end in zero..

18. The area of the square is $2017^2$. The area that the goat can reach is $\frac{1}{4}2017^2\pi$, because it is one fourth of a circle with radius 2017. Thus, the answer is $\frac{\pi}{4}$ $(D)$.

19. Because his number is not prime, it can only be 1, 4, 6, 8. Condition III limits this to only 1, 4, 8. 1 and 4 are both factors of 68, so the answer must be 8 $(D)$.

20. The resulting triangle has either base 3 or 4. If the base has length 4, then the triangle has height 3. If the the base has length 3, then the triangle has height 4. Either way, the area of this triangle will be $3 * 4/2 = 6$ $(C)$.

21. If you look closely, you can see how a pattern forms when multiplying numbers in the form 11...1. For example, $11 \times 11 = 121$. $111 \times 111 = 12321$. Here, $1111 \times 1111 = 1234321$. Adding the digits of this product gives 16 $(D)$.

$$
\begin{array}{r}
1\,1\,1\,1 \\
\times \quad 1\,1\,1\,1 \\
\hline
1\,1\,1\,1 \\
1\,1\,1\,1\phantom{\,1} \\
1\,1\,1\,1\phantom{\,1\,1} \\
1\,1\,1\,1\phantom{\,1\,1\,1} \\
\hline
1\,2\,3\,4\,3\,2\,1
\end{array}
$$

22. Using the identity $a^2 - b^2 = (a-b)(a+b)$, we can simplify this series into $(1000-999)(1000+999)+(998-997)(998+997)...(2-1)(2+1)$. The first term of each of these is equal to 1. Thus, in the end, the series is merely the sum of the first 1000 positive integers.
$1000+999+998+997+996+995+994+...+4+3+2+1$ Using the formula for the sum of the first $n$ positive integers, we find that this is equal to $1000(1001)/2 = 500500$ $(D)$.

23. Notice that whenever a 2 digit number is multiplied by 101, the result is the two digit number repeated. Thus, $ACA$ must be 101, and therefore $C = 0$ $(A)$.

24. Area is proportional to the side length squared, so I cannot be true, but V is. Because the new triangle is similar to the original, the measure of the angles should still be the same. Thus, II is false and III is true. IV is also true. Therefore our answer is III, IV, V $(E)$.

25. The first case is that James immediately rolls Jane's color. The probability of this is $\frac{1}{8}$. The second case is that James misses Jane's color, then Jane misses James' color, and finally James rolls Jane's color. The probability of this is $\frac{7}{8} \cdot \frac{7}{8}\frac{1}{8}$. The third case is that instead of James rolling Jane's color on his second roll as in case 2, he misses her color. Then, Jane must miss her color, and finally James must roll Jane's color. This means that the probability for case 3 is $\frac{7}{8} \cdot \frac{7}{8} \cdot \frac{7}{8} \cdot \frac{7}{8} \cdot \frac{1}{8}$. There are infinitely many cases, as James could miss as many times as he wants as long as Jane misses as well immediately after. These cases form a geometric sequence with common ratio $\frac{7}{8} \cdot \frac{7}{8}$. Using the formula for the sum of an infinite geometric sequence, we find that it evaluates to $\frac{\frac{1}{8}}{1-\frac{7}{8}\cdot\frac{7}{8}} = \frac{\frac{1}{8}}{\frac{15}{64}} = \frac{8}{15}$ $(D)$.