FLORIDA ASSOCIATION OF MU ALPHA THETA
3rd ANNUAL HELEN DOSTAL MAIL–IN COMPETITON
DECEMBER 5, 2001

1. D. 3 - the degree of a polynomial is the highest sum of the exponents of the variables of any one term.

2. C. $\sim p \vee q$, the only time $p \rightarrow q$ is false when p is true q is false. The only time $\sim p \vee q$ is false when they are both false. See table below.

p	q	$\sim p$	$p \rightarrow q$	$\sim p \vee q$
T	T	F	T	T
T	F	F	F	F
F	T	T	T	T
F	F	T	T	T

3. D. -6 - $\dfrac{6(x-2)}{(x-2)(x-3)} = \dfrac{6}{(x-3)}$, substituting in the 2 for the removed x value $\dfrac{6}{2-3} = \dfrac{6}{-1} = -6$

4. A. 32240_{five} - from base seven to base 10,
$(4 \times 1) + (5 \times 7) + (2 \times 49) + (6 \times 343) = 2195$, then changing from
$2195 \div 5 \rightarrow 439\ R\ 0$
$439 \div 5 \rightarrow 87\ R\ 4$
base 10 to base five, $87 \div 5 \rightarrow 17\ R\ 2$
$17 \div 5 \rightarrow 3\ R\ 2$
$3 \div 5 \rightarrow 0\ R\ 3$

5. C. 2 - rules II and IV are true

6. A. 135 minutes - $\dfrac{80 \bullet 240}{60} = \dfrac{90 \bullet 480}{x}$

7. C. \$9120.00 - First find the rate (0.065 or 6.5%) using the formula and then apply the formula to the \$6000 for 8 years.

8. D. cannot be determined from the given information

9. B. 40,320 - 8!

10. B. -21 - multiply the top row by -1 and bottom row by -3 and add all rows together, $-7y = 147$ and $y = -21$.

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11. C. 3 - I is the only one not necessarily true

12. C. $75\sqrt{3}$ - the radius is the hypotenuse of a 30-60-90 triangle with the apothem and one-half of the side of the equilateral triangle as the legs. The longer leg, $5\sqrt{3}$, is one-half of the side of the equilateral triangle, and therefore the side is $10\sqrt{3}$. Using the formula $A = \frac{s^2\sqrt{3}}{4}$ we can find the area.

13. B. 60 mph - $d = rt$, the round trip is 480 miles and the rate is 45 mph. This means the round trip time must be ten and two-thirds hours. The trip there took six and two-thirds hours, which means the return trip must take only four hours. 240 miles in 4 hours is 60 mph.

14. A. $\begin{bmatrix} \frac{1}{2} & \frac{3}{2} \\ -\frac{1}{4} & -\frac{5}{4} \end{bmatrix}$ - if $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then $A' = \frac{1}{ad - bc} \bullet \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$

15. D. 210 - $\frac{9!}{4!\,3!\,3!} = 420$ we use 9! because it is a bracelet and a circle, and then because it is a bracelet and can be flipped over with change we divide by 2, $\frac{420}{2} = 210$.

16. D. 5 - $9^{\log_9 9} = 9$ is the only one not true

17. C. 9 - using the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, with the two given points the slope of the line is found to be 2. Using the slope formula, the slope, one of the given points and the point with the missing x value we solve to find the missing value to be 9.

18. E. NOTA - we can demonstrate $v > w > x > y$ and $v > z > x > y$, therefore for all the pairs given a relationship can be shown. The only pair where no relationship can be shown is for w and z.

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19. B. The area of the larger square is twice the area of the smaller square. - if the length of the side of the larger square is *x*, then the radius of the circle will be one-half that length. The radius of the circle is $\sqrt{2}$ times the one-half the length of a side of the smaller square. Squaring both quantities yields their relationship.

20. B. $600 - \frac{400\pi + 150\sqrt{3}}{3}$ - area of each circle is 100π. Area of overlap is $\frac{200\pi - 150\sqrt{3}}{3}$. Area of the rectangle is 600.

21. B. $93.75\,\%$ - Since half of the 1 out of 8 days have a rainbow, that means that 1 out of 16 days have a rainbow and 15 out of 16 do not.

22. D. 95%

23. D. $x^2 - 3x + 4$ -

$$x^4 - x^2 + 16 + 9x^2 - 9x^2 = x^4 + 8x^2 + 16 - 9x^2 = \left(x^2 + 4\right)^2 - 9x^2$$

24. A. 1 - the only solution is at $(-5,\ 0)$.

25. B. 53 - The fraction is $\frac{53}{66}$

26. E. NOTA - The solution is $\{0,\ 7\}$. $x^2 - 7x = 0$, factoring $x(x - 7) = 0$, and then setting each factor equal to zero.

27. B. $\frac{1}{5}$ - odd in favor of an outcome refer to the number of times a desired outcome occurs over the number of times it does not. Here the number of times it occurs is 6 and the number of times it does not is 30.

28. D. the origin

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29. A. $\frac{ab - ac + 4y}{y} - xy - 4y = ab - ac$ implies

$xy = ab - ac + 4y$ implies $x = \frac{ab - ac + 4y}{y}$

30. B. $-\frac{1}{2} - \left(\frac{1}{3^5}\right)^{3x} = \left(3^3\right)^{2-x}$ which becomes $\left(3^{-5}\right)^{3x} = 3^{3(2-x)}$ and then $3^{-15x} = 3^{6-3x}$, since the bases are the same the exponents must be equal, $-15x = 6 - 3x$, and then solving.