For all questions, answer choice (e) NOTA stands for "None of These Answers"

1. If $\sec(\theta) > 0$ and $\sin(\theta) < 0$, which of the following *could be* the angle θ?

   (a) -1019° (b) -3128° (c) -1492° (d) -3767° (e) NOTA

2. Albert the Alligator stands in the middle of the University of Florida campus and looks up at the top of Century Tower (he is in awe of a banner proclaiming the Gators as "2006 football *and* basketball national champions"). The angle of elevation to the top of the tower is 30°. Albert then walks a certain distance and looks up at the top of the tower once again. The new angle of elevation is 45°. If the distance between Albert and the base of the tower is now 100ft, how far did Albert walk?

   (a) $100(\sqrt{2}+1)$ (b) $100(\sqrt{2}-1)$ (c) $100(\sqrt{3}-1)$ (d) $100\sqrt{3}$ (e) NOTA

3. Solve for x: $(2^x)(4^{2x+1}) = 8$.

   (a) 1/5 (b) 2/3 (c) 4/5 (d) 2/5 (e) NOTA

4. Simplify: $\dfrac{Sin(12x)+Sin(2x)}{Cos(12x)-Cos(2x)}$.

   (a) Cot(5x) (b) Tan(12x) (c) Tan(5x) (d) Tan(7x) (e) NOTA

5. $f(x) = \text{Log}_x(x+1)$ for all values of $x > 1$.

   $$\prod_{4}^{31} f(x) = ?$$

   (a) 3/5 (b) 5/2 (c) 4/5 (d) 1/2 (e) NOTA

6. Find the area of the conic section: $2x^2 + 8x + 3y^2 - 12y - 4 = 0$.

   (a) 24π (b) $4\sqrt{6}\,\pi$ (c) 96π (d) $6\sqrt{3}$ (e) NOTA

7. Find the sum of all possible values of θ on the interval $[0, 2\pi)$ such that $\tan^2(\theta) = \frac{1}{3}$ and $\sin(\theta) < 0$.

   (a) 3π (b) 4π (c) π (d) $7\pi/6$ (e) NOTA

8. Which of the following trig ratios could not be π?

   (a) $\cos(\theta)$ (b) $\tan(\theta)$ (c) $\csc(\theta)$ (d) $\cot(\theta)$ (e) NOTA

9. $\text{Cos}(22.5°) = ?$

(a) $(1/4)(\sqrt{2} + \sqrt{6})$ (b) $(1/4)(\sqrt{2+\sqrt{2}})$ (c) $(1/4)\sqrt{2-\sqrt{2}})$ (d) $\sqrt{6}$ (e) NOTA

10. The following transformations are performed in order on the graph of f(x) = Sin(x).

i. Reflection through the x-axis
ii. Horizontal shrink by a factor of ¼
iii. Reflection through the y-axis
iv. Horizontal translation π units to the left
v. Vertical stretch by a factor of 3

Which of the following is the graph, g, of the resulting function?

(a) g(x) = 3Sin(1/4(x - π)) (b) g(x) = -3Sin(-1/4(x - π)) (c) g(x) = -1/3Sin(4(π - x))

(d) g(x) = -3Sin(-4(x + π)) (e) NOTA

11. Find an algebraic expression equivalent to Sin[Arcsin(x) + Arccos(x)].

(a) 1 (b) Tan(x) (c) $2x^2 - 1$ (d) $x + \sqrt{1-x}$ (e) NOTA

12. If $f(x) = 2x + 8$, $g(x) = \dfrac{4x-2}{x}$ and $h(x) = g(f(x))$, then $h^{-1}(x) = ?$

(a) $\dfrac{30-8x}{x-8}$ (b) $\dfrac{x+4}{4x+15}$ (c) $\dfrac{15+4x}{x+8}$ (d) $\dfrac{15-4x}{x-4}$ (e) NOTA

13. Solve for x: $\ln(x + 2) + \ln(x + 8) = 0$

(a) $\dfrac{e-10}{2}$ (b) $-5 \pm \sqrt{10}$ (c) $-10 + 2\sqrt{10}$ (d) $-10 - 2\sqrt{10}$ (e) NOTA

14. $f(x) = [1 + \tan(x)]^2 - \sec^2(x)$.

If A is the amplitude of f(x) and P is the period of f(x), find $\dfrac{AP}{2}$.

(a) 2π (b) π (c) 2/π (d) 1 (e) NOTA

15. Which of the following is *not* an element of the domain of f(x) = cot(x)

(a) – 240° (b) 450° (c) 1440° (d) – 405° (e) NOTA

16. The terms in the expansion of $(x + 2/x^2)^9$ are written from left to right in descending powers of x. Which term is the constant term?

(a) 4^{th} (b) 6^{th} (c) 8^{th} (d) 10^{th} (e) NOTA

17. Which of the following is/are true?

I. $\cos(2x) = 1 - \cos^2(x)$ II. $\sin(2x) = 2\tan(x)\cos^2(x)$

III. $\cos(2x) = 1 - 2\sin^2(x)$ IV. $\tan(x) = \sqrt{\sec(x) - 1}$

(a) I only (b) I and II only (c) II and III only (d) all are true (e) NOTA

18. Charlie can solve a problem twice as fast as Jim and Jim can solve the same problem twice as fast as Donna. When all three people work on the problem together, it takes them 10 minutes to solve it. How long does it take Jim to solve the problem?

(a) 35 minutes (b) 18 minutes (c) 36 minutes (d) 72 minutes (e) NOTA

19. Triangle ABC has angles A, B and C and sides a, b and c. Side a is opposite angle A, side b is opposite angle B, and side c is opposite angle C. A = 30°, b = 10, c = 10 and a = $\sqrt{x - y\sqrt{z}}$ where x, y and z are positive integers. Find $x + y + z$.

(a) 300 (b) 301 (c) 302 (d) 303 (e) NOTA

20. Which of the following is the locus of points equidistant from a particular point in space?

(a) Hyperbola (b) Ellipse (c) Parabola (d) Circle (e) NOTA

21. The general form for a conic section is $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$. If $B^2 - 4AC = 0$, then the type of section could *not* be which of the following?

(a) parabola (b) 2 parallel lines (c) 1 line (d) hyperbola (e) NOTA

22. If $\sin(\theta) = 3/5$ and $\pi/2 < \theta < 3\pi/2$, then $\cos(\theta) + \cot(\theta) = ?$

(a) 8/15 (b) – 32/15 (c) – 31/20 (d) – 9/10 (e) NOTA

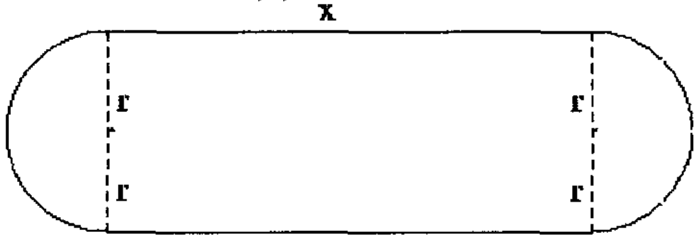
23. In a circle whose diameter is 16 cm, a central angle θ intercepts an arc of length 3 cm. What is the radian measure of the angle θ?

(a) 9/16 (b) 3/8 (c) $9\pi/16$ (d) $3\pi/8$ (e) NOTA

24. If $\log_b x = 2.3$ and $\log_b y = 3.1$, find $\log_b(b^5x^2/y^3)$.

(a) 0.3 (b) 10.4 (c) 3 (d) – 4.7 (e) NOTA

25. Florida Field (better known as "The Swamp") has the shape of a rectangular region with semicircular regions at each end. If the perimeter of the field is 400 yards, express the area of the field as a function of the radius, r, of the semicircles.



(a) $f(r) = 400\pi r$ (b) $f(r) = 2r(200 - \pi r)$ (c) $f(r) = r(400 - \pi r)$

(d) $f(r) = 400r + \pi r^2$ (e) NOTA

26. What is the remainder when 2^{519} is divided by 5?

(a) 1 (b) 2 (c) 3 (d) 4 (e) NOTA

27. Find the minimum value of the function $f(x) = 2x^2 + 2x + 5$.

(a) 9/2 (b) 19/4 (c) 0 (d) 5 (e) NOTA

28. Find an equation of the circle which has the line segment from $P(-2, 3)$ to $Q(6, -1)$ as a diameter.

(a) $(x-4)^2 + (y-1)^2 = 400$ (b) $(x-2)^2 + (y-1)^2 = 20$ (c) $(x-4)^2 + (y-1)^2 = 20$

(d) $(x-2)^2 + (y-1)^2 = 400$ (e) NOTA

29. What is the <u>discriminant</u> ($b^2 - 4ac$) of the quadratic function with leading coefficient one and roots that are each two greater than those of the equation: $x^2 + 4x - 8 = 0$

(a) 48 (b) – 48 (c) $4\sqrt{3}$ (d) – 16 (e) NOTA

30. What is the least possible score you cannot achieve on this test if you receive 4 points for a correct response, 0 points for a response left blank, and -1 points for an incorrect response?

(a) 107 (b) 109 (c) 113 (d) 117 (e) NOTA

1. A = the coefficient of the 4^{th} term in the expansion of $(2x + 3)^7$
   B = the sum of the coefficients of the terms in the expansion of $(8x - 2)^3$
   Find $\frac{A}{B}$.

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2. (x_1, y_1) is the focus of $\frac{(x-2)^2}{289} + \frac{(y-1)^2}{64} = 1$ that lies in the second quadrant and (x_2, y_2) is the focus of $\frac{x^2}{25} - \frac{y^2}{144} = 1$.
   Find the distance between (x_1, y_1) and (x_2, y_2).

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3. A = the sum of the first 20 positive integers.
   B = the sum of the squares of the first 20 positive integers.
   C = the sum of the cubes of the first 20 positive integers.
   Find $\frac{BC}{A}$.

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4. Find all zeros of the polynomial $f(x) = x^3 - 2x^2 + ix^2 + 2x - 2ix - 4$.

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5. Identify the two points where the vertical asymptotes of $y = \frac{2x^2}{15x^2 - 7x - 36}$ intersect its horizontal asymptote.

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6. A = the area of a triangle with sides 13, 14, 15
   B = the area of a triangle with sides 6, 7, 8
   C = the area of a triangle with sides 17, 18, 19
   Find $A^2 + B^2 + C^2$.

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7. What is the units digit of $(7^{345})(3^{1083})$?

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8. $\cos(x) = 14/15$ and $3\pi/2 < x < 2\pi$; $A = \tan(2x)$, $B = \sec^2(x)$, $C = \sin(x)$, and $D = \cot(x)$; Arrange A, B, C and D in order from least to greatest.

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9. Find the smallest positive integer with exactly 21 positive integral divisors.

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10. G = the 10th triangular number.
    $A = {}_{G}C_{53}$
    $T = A/33$
    O = the sum of the prime divisors of T.
    R = the day of the week on which the "Oth" day of February 2008 will fall.
    Find R.

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11. Find the sum of the solutions on the interval $0 < x < 4\pi$:

$$\sin(x)\cos(x) + \frac{\sin(x)}{2} - \cos(x) - \frac{1}{2} = 0$$

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12. $240^{12} = (30)(5^x)(2^y)(3^z)$. Find $x + y + z$.

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13. If $\cos(x) = \cos^3(y) - 3\sin^2(y)\cos(y)$, solve for x in terms of y.

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14. Simplify:
    $\text{Sin}^2(xyz) - \text{Cos}^2(xy) + \text{Cos}^2(yz) + \text{Cos}^2(zxy) - \text{Cos}^2(zy) + \text{Cos}^2(yx)$

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15. It can be shown that $\cos(4x) = A\cos(Bx)\cos(x) - \cos(Cx)$ where A, B and C are positive integers. Find $A + 2B + C$.

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1. C
2. C
3. A
4. E
5. B
6. B
7. A
8. A
9. E
10. D
11. A
12. D
13. E
14. B
15. C
16. A
17. C
18. A
19. D
20. E
21. D
22. B
23. B
24. A
25. C
26. C
27. A
28. B
29. A
30. B

January Regional Solutions — Pre-Calculus Individual

1. The terminal side of θ must lie in the 4^{th} quadrant => $-1492° + 5(360°) = 308°$ => **C**

2. Let x be the distance walked. Then (100)sqrt(3) = x + 100 => x = (100)sqrt(3) – 100 => x = 100(sqrt(3) – 1) = > **C**

3. $(2^x)(2^{2(2x+1)}) = 2^3 \Rightarrow 2^{5x+2} = 2^3 \Rightarrow 5x + 2 = 3 \Rightarrow 5x = 1 \Rightarrow$ x = 1/5 => **A**

4. $\dfrac{\text{Sin}(7x+5x)+\text{Sin}(7x-5x)}{\text{Cos}(7x+5x)-\text{Cos}(7x-5x)} = \dfrac{\text{Sin}(7x)\text{Cos}(5x) + \cancel{\text{Cos}(7x)\text{Sin}(5x)} + \text{Sin}(7x)\text{Cos}(5x) - \cancel{\text{Cos}(7x)\text{Sin}(5x)}}{\cancel{\text{Cos}(7x)\text{Cos}(5x)} - \text{Sin}(7x)\text{Sin}(5x) - \cancel{\text{Cos}(7x)\text{Cos}(5x)} - \text{Sin}(7x)\text{Sin}(5x)}$

   $= \dfrac{2\text{Sin}(7x)\text{Cos}(5x)}{-2\text{Sin}(7x)\text{Sin}(5x)} = -\text{Cot}(5x)$ => **E**

5. $(\text{Log}_4 5)(\text{Log}_5 6)\ldots(\text{Log}_{30} 31)(\text{Log}_{31} 32) = \dfrac{\cancel{\text{Log}(5)\text{Log}(6)}\ldots\cancel{\text{Log}(31)}\text{Log}(32)}{\text{Log}(4)\cancel{\text{Log}(5)}\ldots\cancel{\text{Log}(30)\text{Log}(31)}} = \dfrac{\text{Log}(32)}{\text{Log}(4)}$

   $= \dfrac{5\text{Log}(2)}{2\text{Log}(2)} = 5/2$ => **B**

6. $(x + 2)^2/12 + (y - 2)^2/8 = 1$…Area of Ellipse = $\pi ab = \pi(12)^{1/2}(8)^{1/2} = 4(6)^{1/2}(\pi)$ => **B**

7. Tan(θ) = sqrt(3)/3 or Tan(θ) = -sqrt(3)/3. If Sin(θ) < 0, then θ must lie in either quadrant III IV => $\theta = 7\pi/6$ or $11\pi/6$ => Sum = $18\pi/6 = 3\pi$ => **A**

8. cos(θ) ranges in value from -1 to 1. Since π is > 1, cos(θ) cannot be π => **A**

9. $[(1 + \cos(45°)/2]^{1/2} = [(1 + \text{sqrt}(2)/2)/2]^{1/2} = ½(2 + \text{sqrt}(2))^{1/2}$ => **E**

10. i. –Sin(x); ii. –Sin(4x); iii. –Sin(-4x); iv. –Sin(-4(x +π)); v. -3Sin(-4(x +π)) => **D**

11. Arcsin(x) = A and Arccos(x) = B…Sin(A + B) = Sin(A)Cos(B) + Cos(A)Sin(B) $= (x)(x) + (1-x^2)^{1/2}(1-x^2)^{1/2} = x^2 + 1 - x^2 = 1$ => **A**

12. h(x) = (4(2x + 8) – 2)/(2x + 8) = (8x + 30)/(2x + 8) = (4x + 15)/(x + 4)…to find the inverse, we switch the x's and y's an solve for y… x = (4y + 15)/(y + 4) => xy + 4x = 4y + 15 => xy – 4y = 15 – 4x => y(x – 4) = 15 – 4x => y = (15 – 4x)/(x – 4) = $h^{-1}(x)$ => **D**

13. $(x + 2)(x + 8) = 1 \Rightarrow x^2 + 10x + 15 = 0 \Rightarrow x = \dfrac{-10 + (40)^{1/2}}{2}$ or $\dfrac{-10 - (40)^{1/2}}{2}$

    …however, only the first solution above works in the original problem and it simplifies to

    $\dfrac{-10 + 2(10)^{1/2}}{2} \Rightarrow -5 + (10)^{1/2}$ => **E**

14. $f(x) = 1 + 2\tan x + \tan^2 x - (1 + \tan^2 x) = 2\tan x$ which has an amplitude A = 2 and a period (π/b for tangent) P = π => AP/ 2 = $2\pi/2 = \pi$ => **B**

15 cot(x) = 1/tanx and tan(0°) would make it undefined. 1440° = 0 + 4(360°) which is equivalent to 0° => **C**

16. $_9C_3$ => raising x to the 6^{th} (the difference) and raising $2/x^2$ to the 3^{rd} (the second # of the combination)...when the are multiplied together the x terms cancel leaving us with a constant. This term is the 4^{th} term (the second # of the combination plus 1) => **A**

17. II and III are true (use trig identities to manipulate) => **C**

18. Charlie = x, Jim = 2x, Donna = 4x...1/x + 1/(2x) + 1/(4x) = 1/10 => 7/4x = 1/10 => 70 = 4x => x = 35/2 and Jim = 2x = 2(35/2) = 35 minutes => **A**

19. Law of Cosines: $a^2 = b^2 + c^2 - 2bcCosA$ => $a^2 = 100 + 100 - 200Cos30°$ => $a^2 = 200 + 200(3)^{1/2}/2$ => $a = [200 + 100(3)^{1/2}]^{1/2}$...of course we could further simplify the radical by pulling out a 10, but the question leaves it in this form => x = 200, y = 100, z = 3 => x + y + z = 303 => **D**

20. Sphere => **E**

21. Cannot be a hyperbola (see pre-calculus book) => **D**

22. In the second quadrant, cos(θ) + cot(θ) = -4/5 + -4/3 = -12/15 -20/15 = -32/15 => **B**

23. Arc Length = (r)(θ) => 3 = 8(θ) => θ = 3/8 => **B**

24. $\log_b(b^5x^2/y^3) = 5 + 2\log_b x - 3\log_b y = 5 + 2(2.3) - 3(3.1) = 5 + 4.6 - 9.3 = 0.3$ => **A**

25. Perimeter = 2x + 2πr = 400...(solve for x in terms of r)...x = (400 - 2πr)/2 = 200 - πr => Area...$f(r) = (2r)(x) + \pi r^2 = 2r(200 - \pi r) + \pi r^2 = 400r - \pi r^2 = r(400 - \pi r)$ => **C**

26. Remainders follow the following pattern...$2^1/5$ has remainder 2, $2^2/5$ has remainder 4 $2^3/5$ has remainder 3, $2^4/5$ has remainder 1...(and the pattern repeats with these four remainders). Thus, if we divide the power (519) by 4 we get 129 remainder 3. This tells us that 2^{519} has the same remainder as $2^3/5$ => 3 => **C**

27. Simply find the y-coordinate of the vertex of the parabola: $y = 2x^2 + 2x + 5$ => $y - 5 + 1/2 = 2(x^2 + x + ¼)$ => $(y - 9/2) = 2(x + ½)^2$ => minimum = 9/2 => **A**

28. Center is the midpoint of PQ = (2,1) and radius is half the distance between P and Q = $(80)^{1/2}/2$...equation of circle is $(x - h)^2 + (y - k)^2 = r^2$ => $(x - 2)^2 + (y - 1)^2 = 20$ => **B**

29. Using quadratic formula, the roots of the original equation are $r = -2 + 2(3)^{1/2}$ and $-2 - 2(3)^{1/2}$...If the new roots are each two greater, then they are $2(3)^{1/2}$ and $- 2(3)^{1/2}$ => an equation with these roots (leading coefficient 1) is $x^2 - 12 = 0$ => new discriminant $(b^2 - 4ac) = 0 - (4)(-12) = 48$ => **A**

30. 109 is the lowest score that is not attainable (everything below it can be achieved) => **B**

January Regional Solutions **Pre-Calculus Division**

Individual

1. C
2. C
3. A
4. E
5. B
6. B
7. A
8. A
9. E
10. D
11. A
12. D
13. E
14. E
15. C
16. A
17. C
18. A
19. D
20. E
21. D
22. B
23. B
24. A
25. C
26. C
27. A
28. B
29. A
30. B

Team

1. 560
2. 1
3. 602,700
4. -2, 7, $3i$ and $-3i$
5. (9/5, 2/15) and (-4/3, 2/15)
6. 7812
7. 3
8. D, A, C, B

   or

   -12/5, -120/119, -5/13, 169/144
9. 576
10. Friday
11. 11π
12. 69
13. 3y
14. 1
15. 10

1. $A = ({}_7C_3)(2^4)(3^3) = \frac{(7)(\cancel{6})(5)(4)(\cancel{3!})}{(4)(\cancel{3})(\cancel{2})(1)(\cancel{3!})}(16)(27) = (35)(16)(27)$

   $B = (5 - 2)^3 = 27 \Rightarrow A/B = (35)(16) =$ **560**

2. Distance from center to foci of the ellipse is c = sqrt(289 – 64) = 15
   => foci of the ellipse are at (17, 1) and (-13, 1) = (x_1, y_1) {in the second quadrant}
   Distance from center to foci of the hyperbola is c = sqrt(144 + 25) = 13
   => foci of the hyperbola are at (13, 0) and (-13, 0) = (x_2, y_2) {on the negative x-axis}

   Using the distance formula, we get sqrt(0 + 1) = **1**

3. $A = n(n + 1)/2 = (20)(21)/2 = 210$
   $B = n(n + 1)(2n + 1)/6 = (20)(21)(41)/6 = (10)(7)(41) = 2870$
   $C = n^2(n + 1)^2/4 = A^2$

   Question asks for $BC/A = BA^2/A = BA = (2870)(210) =$ **602,700**

4. Use synthetic division:

-2/	1	-5	-5	-45	-126
		-2	14	-18	126
	1	-7	9	-63	\0
7/					
		7	0	63	
	1	0	9	\0	

   Factors to $(x + 2)(x - 7)(x + 3i)(x - 3i)$

   => zeros are: **-2, 7, 3*i* and -3*i***

5. Vertical asymptote occurs where denominator is zero => bottom factors to
   $(5x - 9)(3x + 4)$ => asymptotes are at x = 9/5 and x = -4/3

   Horizontal asymptote occurs at y = 2/15 (leading coefficient over leading coefficient)
   The vertical asymptotes intersect the horizontal asymptotes at the points:

   (9/5, 2/15) and (-4/3, 2/15)

6. Using Heron's formula: $[s(s-a)(s-b)(s-c)]^{1/2}$ where $s = (a + b + c)/2$

   $A = [(21)(8)(7)(6)]^{1/2} = (7056)^{1/2}$
   $B = [(12)(5)(4)(3)]^{1/2} = (720)^{1/2}$
   $C = (1/2)(3)(4) = 6$ (this is a right triangle)

   $A^2 + B^2 + C^2 = 7056 + 720 + 36 =$ **7812**

7. 346 divided by 4 has a remainder of 2 => 7^{346} has the same units digit as $7^2 = 9$
1083 divided by 4 has a remainder of 3 => 3^{1083} has the same units digit as $3^3 = 7$

When you multiply the two together, the units digit times units digit is (7)(9) = 63

=> the 6 gets carried and the **3** is the units digit of the final answer.

8. $\tan(2x) = 2\tan(x)/(1 - \tan^2(x))$ => The angle x is in the 4th quadrant where
$\tan(x) = -5/12$ => $\tan(2x) = \dfrac{(2)(-5/12)}{1-(-5/12)^2} = \dfrac{-5/6}{119/144} = -120/119 = A$
$B = (13/12)^2 = 169/144$, $C = -5/13$, $D = -12/5$
=> order from least to greatest is **D, A, C, B** *or* **-12/5, -120/119, -5/13, 169/144**

9. A number's total # of positive integral divisors can be determined by taking the powers of the prime numbers in the prime factorization, adding one to each, and multiplying the resulting numbers together. Example: $12 = (2^2)(3^1)$ => (2 + 1)(1 + 1) = (3)(2) = 6 total positive integral divisors.

If a number has 21 positive integral divisors, then we either need to obtain (7)(3) or (21)(1) {which clearly does not work}...if 7 and 3 are each one more than the powers in the prime factorization, then the number is of the form $(A^6)(B^2)$ where A and B are distinct prime numbers...the smallest that this can be is $(2^6)(3^2) = (64)(9) =$ **576**

10. G = (10)(11)/2 = 55; A = $_{55}C_{53}$ = (55)(54)/2 = 1485; T = 1485/33 = 45; O = 3 + 5 = 8; For R the students can use the day of the week that the competition falls on and do the math. The 8th day in February 2008 will occur on a **Friday**

11. Factors to: $(\cos(x) + ½)(\sin(x) - 1) = 0$ => $\cos(x) = -1/2$ or $\sin(x) = 1$
$x = 2\pi/3, 4\pi/3, 8\pi/3, 10\pi/3$ or $x = \pi/2, 5\pi/2$ => Sum = $24\pi/3 + 6\pi/2 = 8\pi + 3\pi$
= **11π**

12. $240^{12} = 5^{(1)(12)} * 2^{(4)(12)} * 3^{(1)(12)} = (5)(2)(3)(5^{11})(2^{47})(3^{11})$ => x = 11, y = 47, z = 11

x + y + z = **69**

13. cos(3x) = cos(2x + x) = cos(2x) cos(x) - sin(2x) sin(x)
$= (\cos^2x - \sin^2x)\cos x - (2 \sin x\cos x)\sin x$
$= \cos^3x - \sin^2x\cos x - 2\sin^2x\cos x$
$= \cos^3x - 3\sin^2x\cos x$ ...Thus, x = **3y**

14. $\text{Sin}^2(xyz)$ – ~~$\text{Cos}^2(xy)$~~ + ~~$\text{Cos}^2(yz)$~~ + $\text{Cos}^2(zxy)$ – ~~$\text{Cos}^2(zy)$~~ + ~~$\text{Cos}^2(yx)$~~
$= \text{Sin}^2(xyz) + \text{Cos}^2(xyz) =$ **1**

15. cos(4x) = 2cos(3x)cos(x) – cos(2x) => A = 2, B = 3, C = 2 => A + 2B + C = **10**