The following were changed at the resolution center at the convention: 30 E

1. $\sin(2x) = 2\sin(x)\cos(x)$, so we have $\sin(x)\cos(2x) = 2\sin(x)\cos(x)$. Cancel out $\sin(x)$ and substitute $\cos(2x) = 2\cos^2(x) - 1$, $y = \cos(x)$ to get $2y = 2y^2 - 1$, so $2y^2 - 2y - 1 = 0$; by quadratic formula, $y = ½ \pm \sqrt{3} / 2$, so $x = \cos^{-1}(½ \pm \sqrt{3} / 2)$ which does not evaluate nicely **E**

2. I is even. II is identically = 1, so it is even. III is squared, so it is also even. IV is odd because sine is odd. V is neither (exponential is never negative, but sine is odd so the function can't be even). VI is odd because tangent and cotangent are both odd. 3 even functions, 2 odd functions, 1 neither so the sum is $2(2) + 3(-3) + ½ = -4 ½$ $(-9/2)$ **B**

3. We use the right triangle with the following sides: hypotenuse from Racheal's eyes to the TV, leg from Racheal's eyes straight forward, leg from that point on the wall up to the TV. The angle between the hypotenuse and long (horizontal) leg of this triangle has the same measure as the angle from the TV to Racheal's eyes (as measured away form horizontal). Let this angle = $30° = \pi/6$. The sine of this angle is = ½ but by the triangle, sine = $h / \sqrt{h^2+100}$, where h is the length of the short (vertical) leg of the triangle. Setting ½ = $h / \sqrt{h^2+100}$, we get $3h^2 = 100$ so $h = 10\sqrt{3} / 3$. To get the total height of the TV, we add 4 = 12/3 feet, so the answer is $12+10\sqrt{3} / 3$ **C**

4. Law of cosines. $x^2 = 64 + 144 - 2(96)(1/2) = 112$, so x = sqrt(112) = 4 sqrt(7) **B**

5. Could be determined with the answer to #4 and Heron's theorem, but this is a trigonometry test so we will use the formula $A = ½ (8)(12)(\sin 60°) = 24$ sqrt3 **A**

6. Note the absolute values. Sin(x) and Cos(x) are always both either equal to 0, 1, or -1, and one of them is always =0, so Maryellen's speed is constantly 5mph. For 20 minutes, she goes 5/3 = 1.66 = 1.7 miles (nearest tenth) **C**

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7. Since the shape is a kite, one set of opposite angles is congruent, with WLOG assume sinA = sinC. There is no more information we can glean however, so the answer is **E**

8. sinB = ½ means that B = 30° or B = 150°. B is an inscribed angle; this means the arc AC is 60° or 300° (which are equivalent). We can move 60° of arc away from point A in two directions, unless B happens to be at one of those points. Hence there may be 1 or 2 such choices for C, and the answer is **D**

9. Law of Sines, so we have 8 / sin80 = x / sin30 = y / sin70. Since sin30 = ½, we can then write x = 4 / sin80, y = 8sin70 / sin80. Divide to get x / y = 1 / 2sin70 = ½ csc70**D**

10. Cosine is the trig function associated with horizontal components. **C**

11. From geometry we know that the sum of exterior angles is always 360°, so sin360° = 0 **A**

12. The period of sinx is 2π, and the period of cos2x is π. Hence, their sum repeats periodically every 2π units on the x axis. **B**

13. The domain of sec(2x) will be all values such that cos(2x) is not = 0. cos2x = 0 when x = π/4, π/2, 3π/4, 3π/2, etc... none of which are included in the given answers. **E**

14. 8391 = 8280+111 = 23(360)+111 so 8391 is coterminal to 111. 2(360)+111 = 720+111 = 831 so 831 is coterminal to 8391 **D**

15. Consider the right triangle with one vertex at the top of the center pole, one vertex at the top of a support pole, and one vertex 20ft up on the center pole. This is a 5-12-13 triangle. The interior angle of the tent is double an angle φ that is opposite the 12ft side of this triangle. Sinθ = sin2φ = 2 sinφ*cosφ = 2 (5/13)(12/13) = 120/169 **A**

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16. Use addition formulas: 75 = 45+30, 15 = 45-30. tan75 = (tan45+tan30) / 1-(tan45)(tan30) = (1+sqrt3/3) / (1-sqrt3/3) = (3+sqrt3)/(3-sqrt3) = 2+sqrt3. **B**

17. On the given interval, the solutions for sinx=0 are π and 2π; solutions for cos 2x = 0 are π/4, 3π/4, 5π/4, 7π/4. The sum is 7π **A**

18. As x⟶ -∞, $e^x \approx 0$, so it intersects sin(x) infinitely many times, once near each solution of sin(x) = 0 for x < 0. **D**

19. Call the angle θ. We know cosθ = u•v / |u| |v| so plugging in the numbers we have, cosθ = 19 / sqrt(410) and then we can determine sinθ = 7 / sqrt(410) since $410-19^2 = 49$. Thus cotθ = cosθ / sinθ = 19/7 **C**

20. A circle has 360 degrees; half the pie for her brother means 180 degrees are left, divide by three then β = 60. csc β = 1 / sin β = 1 / (sqrt3/2) = 2 / sqrt3 = 2 sqrt3 / 3 **D**

21. Arctan(1) = π/4; Arctan(0) = 0 **B**

22. Sin(x) is defined for all real numbers, with range between -1 and 1, all of which are in the domain of Arctan. **D**

23. Cosine is negative in quadrants II and III; tangent is negative in quadrants II and IV, so θ is in quadrant II. **B**

24. Factoring by difference of squares, we get $(\cos^2 x + \sin^2 x)(\cos^2 x - \sin^2 x) = (1)(\cos 2x)$ **A**

25. x = sqrt2 / 2, so the answer is 2+sqrt2 rounded to the nearest tenth. Sqrt2 + 1.41... so the answer is 3.41... = 3.4 **B**

26. Since 2010 is even, there are twice that many petals, 4020. **C**

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27. $\sec\alpha = 1/\cos\alpha = 13/5$, so $\sec^2\alpha = 169/25$. Alternatively, one could use the identity $\sec^2\alpha = 1 + \tan^2\alpha$ **D**

28. $87 = 29*3$, so $87/180 = 29/60$; thus $87° = 29\pi / 60$ radians **A**

29. $f(\pi/6) = \cos^2(\pi/6) + \sin(\pi/3) = (\text{sqrt}3/2)^2 + \text{sqrt}3/2 = ¾ + \text{sqrt}3/2 = (3+2\text{sqrt}3) / 4$ **B**

30. Clearly ABC could be a right triangle with sides of length 10, 24 and 26 (double a 5-12-13), however since the given measurements are Angle-Side-Side (or SSA) there are two possibilities; the other triangle has $c \approx 18.3$, so perimeter ≈ 52.3 **E**