Solutions:

1. If \( x = \sqrt{5 - \sqrt{5}} \ldots \) then \( x^2 = 5 - x \). Using the quadratic formula and knowing that the value of \( x \) is positive, we get
\[ x = \frac{-1 + \sqrt{21}}{2} \]. Choice A.

2. \( 2^{2x} \cdot 2^x = 2^{3x} \). Choice D.

3. \( \frac{2 \sin x \cos x}{\sin x} = \frac{a}{b} \). \( 2 \cos x = \frac{a}{b} \). \( \cos x = \frac{a}{2b} \). Choice B.

4. Since \( \sin^2 x + \cos^2 x = 1 \), choices A and B are true. By definition of Tangent and Secant, choices C and D are true. All are true. Choice E.

5. \( \tan 54^\circ = \frac{10 - 0.2t}{5} \) gives that it will take 15.59045199 minutes. This makes the time 12:15:35. Remember that 0.59 of of minute is not equal to 59 minutes. Choice A.

6. The slope of the two points is 2 so the perpendicular line has slope \(-\frac{1}{2}\). Substituting the point into the line gives \( x + 2y = 101 \) and \(-4 + 2k = 101\) and \( k = 52.5 \). Choice C.

7. Using the law of cosines,
\[ 81 = 16 + 36 - 2(4)(6)\cos A \]
which solves to \( \cos A = -\frac{29}{48} \). Choice D.

8. Using the identity \( 2 \sin x \cos x = \sin(2x) \)
we get \( y = \frac{1}{2} \sin 2x \) which has period \( \pi \). Choice B.

9. \( \cos(2\cos \theta - 1) = 0 \) gives \( \cos \theta = 0 \) or \( \cos \theta = \frac{1}{2} \). This gives solutions
\[ \frac{\pi}{2}, \frac{3\pi}{2}, \frac{\pi}{3}, \frac{5\pi}{3} \] and with denominator 6,
\[ \frac{3\pi}{6}, \frac{9\pi}{6}, \frac{2\pi}{6}, \frac{10\pi}{6} \]. So a=2, b=3, c=9, d=10.
The sum b+d = 13, which is choice B.

10. \( \left( \sqrt{3} \right)^2 + k^2 = \sqrt{5 + 2\sqrt{6}} \) by the Pyth.
Th. So \( (\sqrt{3} + k^2)^2 = 5 + 2\sqrt{6} \). So
\( k^2 = \frac{\sqrt{2}}{2} \) and \( k = \frac{\sqrt{2}}{2} \).
\( k^6 = \frac{2^6}{2^6} = \frac{2^3}{2^3} = \sqrt{2} \). Choice C.

11. Using Heron's formula, the area of the triangle is \( \sqrt{7(7-5)(7-6)(7-3)} \). Which gives area \( 2\sqrt{14} \) and so \( 2\sqrt{14} = \frac{1}{2}(6)h \) and \( h = \frac{2\sqrt{14}}{3} \). Choice D.

12. The length BD is half of AE. So \( 2 \cos \theta = \sin \theta \) and \( \tan \theta = 2 \) in quadrant I. So \( \theta^2 - \theta \) was approximately 0.119, choice C.

13. To get \( f(3) \) we substitute \( x = 4 \).
\( \sqrt{12} = 2\sqrt{3} \), choice B.

14. The surface area will be the original surface area (6 times 64) minus the area of an isosceles right triangle of hypotenuse 1, on three faces. This is \( 3 \left( \frac{1}{2} \cdot \frac{1}{\sqrt{2}} \cdot \frac{1}{\sqrt{2}} \right) \) or \( \frac{3}{4} \). Plus the area of the equilateral triangle face: \( \frac{\text{side}^2}{\sqrt{3}} = \frac{1}{4}\sqrt{3} \).
Getting a common denominator 4, gives
\[ \frac{1536-3+\sqrt{3}}{4} = \frac{1533+\sqrt{3}}{4} \]. Choice B.

15. The angle between the vectors is 100°.
Using the law of cosines gives
\( 900 + 25 - 2(30)(5)\cos 100° \approx 31.3 \) mph.
Choice D.

16. \( \frac{12x}{13x} = \frac{12}{5} \) which is choice A.

17. \( \cos(a + b) = \cos a \cos b - \sin a \sin b \).
\( c \sqrt{1 - d^2} - d \sqrt{1 - c^2} \). Choice C.
18. Using the Pythagorean Theorem, we get
\[ 4 \log x + (\log x)^2 = 12 \text{ or } (\log x)^2 + 4 \log x - 12 = 0 \text{ and so} \]
\[ (\log x + 6)(\log x - 2) = 0 \]
\[ \log x = -6 \text{ or } \log x = 2. \] Using the second answer, \( \cos \theta = \frac{2\sqrt{2}}{3} = \frac{\sqrt{6}}{3} \) is choice C.

19. The volume of the dog is the volume of the cylinder \( V = \pi r^2 h = \pi (16)(3) = 48\pi \) which is choice C. The height of the water after the dog leaves it is irrelevant.

20. Let \( x \) be the larger side of the small rectangle and \( y \) be the smaller side of the small rectangle. \( 5x + 8y = 72 \) and from the picture we see \( 3x = 6y \) (opposite sides are congruent). Substituting gives
\[ 5(2y) + 8y = 72 \text{ and } y = 4, x = 8. \] The perimeter of a small rectangle is 24. Choice B.

21. This is the ambiguous case of SSA and this triangle has two solutions. Using the law of sines, we get \( \frac{\sin C}{12} = \frac{\sin 40}{8} \) and \( \sin C \approx 0.96418 \) which may be the angle 74.62 or 105.38 degrees. When \( C \) is 105.38 degrees, \( B = 36.4 \) deg., choice A.

22. \((\cos x + \cos y)^2 = \frac{1}{4}\) and \((\sin x - \sin y)^2 = \frac{1}{9}\)
\[ \cos^2 x + 2 \cos x \cos y + \cos^2 y = \frac{1}{4} \text{ and} \]
\[ \sin^2 x - 2 \sin x \sin y + \sin^2 y = \frac{1}{9}. \] Add and use the fact that \( \cos^2 x + \sin^2 x = 1 \) to get
\[ 2 + 2(\cos x \cos y - \sin x \sin y) = \frac{13}{36}. \]
Solving for the parentheses gives
\[ \cos(x + y) = \frac{-59}{72} \] which is choice B.

23. The sum of 8x and 3x is 11x which equals 44. So x=4 and black beads are 8(4)=32 which is choice D.

24. \( \log_2 \left( \frac{x}{9} \right) = 4 \) and \( 16 = \frac{x}{9} \) so \( x = 9(16). \)
\[ 2 \sqrt{x} = 2 \cdot 3 \cdot 4 = 24 \] is choice A.

25. f is the parabola with vertex (1,0) and which opens to the left such that \( \frac{1}{4a} = 2 \)
and so \( a = \frac{1}{8} \) and the equation is
\[ -\frac{1}{8}y^2 = (x - 1). \] If \( y = 4 \) then \( x = -1. \) Choice D.

26. Complete the square to get
\[ (x - 2)^2 + (y + 3)^2 = 16. \] The minimum value of \( f \) is the distance from the center (2, -3) to the point (10, 12) minus the length of the radius 4. The distance is 17, using the distance formula, minus 4 is 13. Choice C.

27. The height to the side of length 16 is requested. Get the area of the triangle using Heron’s formula. This is approx. 32.726. Set this equal to \( \frac{1}{2}(16)x, \) and \( x \) is approximately 4.1, or choice A.

28. Using \( A = \frac{1}{2}bh, \) \( \frac{1}{2}(10)h = 20, \) \( h = 4. \) So the point (K, 4) lies on the line \( x - 4y = 2. K \) is then 18, and we want the distance from (0,0) to (18,4) which is approximately 18.4. Choice C.

29. Since \( x < 0, \) \( \sqrt{2x} \) and \( \sqrt{8x} \) are not real and thus we cannot use \( \sqrt{a} \cdot \sqrt{b} = \sqrt{ab}. \) Thus choice A is false. The product of two imaginary numbers is negative, so \( -4|x| \) is the only possible answer. NOT \( -4x \) since \( x \) is negative, and this product will be positive. Choice D.

30. The slope of the line is \( \tan 30^o = \frac{1}{\sqrt{3}} \) and so the equation through (0,0) is \( x - \sqrt{3} y = 0. \) Since \( x = \sqrt{3} y \) we get \( 6(\sqrt{3} y) - 3(3y^2) = y \) and this solves to \( y = 0 \) or \( y = \frac{6\sqrt{3} - 1}{9} \), so 27n gives choice A.