D 1. \(2^{\frac{1}{m}} = 2^{\frac{4}{3}}; m = \frac{3}{4}\)

D 2. \[
\frac{(n+1)!}{(n-2)!n} = \frac{(n+1)(n)(n-1)(n-2)!}{(n-2)!n} = n^2 - 1
\]

C 3. \((y^2 + \frac{1}{y^2})\) would be the constant term. \(\frac{10!}{5!5!} \left(\frac{1}{y^2}\right)^5\) which is 252

D 4. \(3^5(3^{2i}) = 3^1(3^{2y}); 2x - 6 = 2 + 2y; x - y = 4\)
\(2^{-2}(2^{4x}) = 2^4(2^{-6y}); -2 + 4x = 4 - 6y; 2x + 3y = 3.\)

Solve the system \(x - y = 4\) and \(2x + 3y = 8.\) This gives \(x = 3, y = -1\) so \(x + y = 2.\)

D 5. Find \(a_1\) when \(a_3 = 26 - 20 = 6\) and \(a_4 = 22 - 20 = 2.\) \(r = \frac{a_4}{a_3} = \frac{1}{3};\)
\[6 = a_1 \left(\frac{1}{3}\right)^2; a_1 = 54; 74^\circ C\]

D 6. \[
\frac{1}{(1+i)^4} + \frac{1}{(1-i)^3} = a + bi; \quad \frac{1}{(1+i)^4} = \frac{1}{(1+i)^2} = \frac{1}{4}; \quad \frac{1}{(1-i)^3} = \frac{1}{(1-i)^2(1-i)} = -\frac{1}{4} + \frac{i}{4}.
\]

\[-\frac{1}{4} + -\frac{1}{4} + \frac{i}{4} = -\frac{1}{2} + \frac{i}{4}, b = \frac{1}{4}.\]

B 7. \(2160 = (n - 2)180; n = 14; \frac{n(n - 3)}{2} = \frac{14(11)}{2} = 77\)

A 8. \[
\frac{2^{n+1} - 2^{n-1}}{2^{2n} - 2^{2n-2}} = \frac{2^n(2^1 - 2^{-1})}{2^n(2^0 - 2^{-2})} = \frac{1 \cdot 2 - 2^{1-n}}{2^n \cdot \frac{3}{4}} = \frac{1}{2^n} \cdot 2 = 2^{1-n}
\]

A 9. \(P(x) = x^3 - 6x^2 + Bx + C\) has roots \(1 + 5i\) and \(1 - 5i.\) Find the quadratic for those two roots:
\[\text{sum of roots} = 2 = -\frac{b}{a}; \quad \text{product of roots} = 26 = \frac{c}{a}.\]
Therefore the quadratic is \(x^2 - 2x + 26 = 0.\) Using long division of polynomials, After the 2\(^{nd}\) step, you get that \(-26 + B - 8 = 0\) making B 34. And \(C + 104 = 0\) making C \(-104.\) Adding these gives \(-70.\)
B 10. Since 1 is the first row, then the 12th row would be \((a + b)^{11}\). First term is found by \(\binom{11}{0}\)
so the 7th term would be \(\binom{11}{6}\) which is \(\frac{11!}{6!5!}\) which is 462.

B 11. Sum of the angles in the quad is 360.

\[ m\angle CAB + m\angle ABD = 175; x + y = \frac{175}{2}, \]

\[ m\angle K = 180 - \frac{175}{2} = 92.5 \]

D 12. Using Pythagorean triples, AD=12 and using altitude to the hypotenuse theorems;

let \(AC = x; 20 = \sqrt{12 \cdot x}, 400 = 12x; x = \frac{100}{3} \).

D 13. \[
\begin{bmatrix}
-1 & 3 \\
4 & 2
\end{bmatrix}
\]^{-1} = \[
\begin{bmatrix}
2 & -3 \\
-4 & -1
\end{bmatrix}
\] = \[
\begin{bmatrix}
-2 & 3 \\
4 & 1
\end{bmatrix}
\begin{bmatrix}
-2 & 3 \\
4 & 1
\end{bmatrix}
\cdot \begin{bmatrix}
1 & -1 \\
0 & 2
\end{bmatrix}
= \begin{bmatrix}
-1 & 4 \\
2 & 1
\end{bmatrix}
\]

C 14. We want \(P(2)\).

A 15. The slope is \(-3\) passing through \((3, -8)\). \(f(x) = -3x + 1\)

C 16. Domain: Denominator cannot be equal to zero so that eliminates \(\pm3\). Numerator: \(\sqrt{x + 2} \geq 0\)
making \(x \geq -2\). Putting the critical points on the number line and testing zones makes the domain \([-2, 3) \cup (3, \infty)\).

C 17. \(\log_8 (x^2 - 1) - \log_8 (7x - 11) = 0\), \(\log_8 \frac{x^2 - 1}{7x - 11} = 0; x^2 - 1 = 7x - 11, x^2 - 7x + 10 = 0; \)
making \(x = 2, 5\). \(|4 - 25| = 21\).

D 18. Since we want the numerator determinants when solving for y, replace the constants in the y column of the determinants. Find the value using either minors or the diagonal

\[
\begin{vmatrix}
3 & -7 & 2 \\
1 & 16 & -4 \\
2 & 14 & -1
\end{vmatrix}
= 133
\]
D 19. \[ \frac{3 - 2x}{\sqrt{2x - 3}} = \sqrt{2x - 2} \]. Since this can be a proportion, cross multiply. This gives
\[ 3 - 2x = 2x - 5\sqrt{2x} + 6 \]. Isolate the root and square both sides:
\[ 4x + 3 = 5\sqrt{2x}, 16x^2 + 24x + 9 = 50x, 16x^2 - 26x + 9 = 0 \]. Solving gives the roots \( \frac{1}{2} \) and \( \frac{9}{8} \). Both of these work so the sum is \( \frac{13}{8} \).

E 20. \[ x^2 + 9x + \frac{81}{4} + y^2 - 8y + 16 = -4 + \frac{81}{4} + 16; \left( x + \frac{9}{2} \right)^2 + (y - 4)^2 = \frac{129}{4}; \]
\[ r = \frac{\sqrt{129}}{2}; C = \sqrt{129}\pi \]

C 21. \[ (x + 3)^2 = 8y - 16; \frac{1}{8}(x + 3)^2 + 2 = y; \] vertex \((-3, 2)\), \( \frac{1}{4p} = \frac{1}{8}, p = 2 \), focus \((-3, 4)\)

B 22. Area of rectangle is 12(5)=60.
Area AECD = a Rectangle - a\( \triangle CBE \).
\[ = 60 - \frac{1}{2} \bullet 5 \bullet 5 = 47 \frac{1}{2}. \]
\[ \frac{a\triangle CBE}{a\square AECD} = \frac{25}{95} = \frac{5}{19}. \]

D 23. Let E be the point where the altitude from A intersects BC. The slope of BC = \( \frac{5}{2} \) making the slope of AE = \( \frac{2}{5} \). Equation of line AE is \( 2x + 5y = 4 \).

B 24. \[ \log_{128} 8 - \log_2 0.25 + \log_3 \frac{1}{81} + \log_9 \sqrt{27} = \frac{3}{7} + 2 - 4 + \frac{3}{4} = -\frac{23}{28}. \]

C 25. \[ 4y - x - 3xy \leq 0; -x - 3xy \leq -4y; x + 3xy \geq 4y; x \left(1 + 3y\right) \geq 4y; x \geq \frac{4y}{1 + 3y}. \]

E 26. \( (\sqrt{3} - \sqrt{5})\left(\sqrt{5} + \sqrt{15} + \sqrt{25} \right) \) is the factored form of the different of cubes.
\( (3 - 5) = -2 \).

D 27. \( lw \bullet wh \bullet lh = (lwh)^2 \)
D 28. \((x + y)^2 = 90, (x - y)^2 = 30\); expanding each gives the system \[
\begin{align*}
  x^2 + 2xy + y^2 &= 90 \\
  x^2 - 2xy + y^2 &= 30 
\end{align*}
\]
solving this gives \(x^2 + y^2 = 60, y0 = 2xy = 30, -2xy = -30, xy = 15\).
\(x^2 - xy + y^2 = 60 - 15 = 45\).

C 29. There are 4 ways to place QU in the sequence: there are \(\binom{3}{3}P_3\) ways to arrange the other 3 letters. There are then 2 ways of arranging Q and U since the order is not important.
\[
\frac{4 \cdot 3 \cdot 3 \cdot 2 \cdot 2}{3 \cdot 2 \cdot 1 \cdot 2 \cdot 2} = \frac{2}{5}
\]

B 30. \(16x^2 + 9y^2 - 96x + 72y + 144 = 0; 16(\frac{x^2 - 6x + 9}{9}) + 9(\frac{y^2 + 8y + 16}{16}) = 144\);
\[
\frac{(x-3)^2}{9} + \frac{(y+4)^2}{16} = 1; \text{center } (3, -4), \text{focus } (3, -4 \pm \frac{\sqrt{7}}{3}), \]
vertices \((3,0), (3,-7), (0,-4), (6,-4)\), Eccentricity \(\frac{c}{a} = \frac{\sqrt{7}}{3}\), major axis length 8, minor axis length 6, area \(12\pi\).

F I. Center is \((3, 4)\)
F II. Eccentricity is \(\frac{\sqrt{7}}{3}\)
T III. Major axis has length 8.
T IV. \((3, 0)\) is a vertex.
T V. The area is \(12\pi\)