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

1. $\left(4^{\sqrt{2}}\right)^{\sqrt{3}} \to 4^{\sqrt{6}} \to 2^{2\sqrt{6}} \to 2^{\sqrt{24}} \to 2^{24^{\frac{1}{2}}} = x \Rightarrow \log_2 x = 24^{\frac{1}{2}}$. **(A)**
2. The midpoint (h, k) is (7, 7). If the two legs have length 7 and 7, the hypotenuse must be $7\sqrt{2}$. **(C)**
3. The x-intercepts are determined from the numerator. $2x-3=0 \Rightarrow x=1.5$. **(B)**
4. If $\frac{1}{x}+\frac{1}{y}=\frac{7}{12}$, then $\frac{y+x}{xy}=\frac{7}{12}$. Since $xy=12$, $x+y=7$. **(C)**
5. $C_{old}=2\pi r=10 \to r=\frac{5}{\pi}$. $SA_{old}=4\pi r^2=4\pi\left(\frac{5}{\pi}\right)^2=\frac{100}{\pi}$. $V_{old}=\frac{4}{3}\pi r^3=\frac{4}{3}\pi\left(\frac{5}{\pi}\right)^3=\frac{500}{3\pi^2}$.

   $SA_{new}=\frac{200}{\pi}=4\pi R^2 \to R^2=\frac{50}{\pi^2} \to R=\frac{5\sqrt{2}}{\pi}$. $V_{new}=\frac{4}{3}\pi R^3=\frac{4}{3}\pi\left(\frac{5\sqrt{2}}{\pi}\right)^3=\frac{1000\sqrt{2}}{3\pi^2}$.

   $\frac{V_{new}}{V_{old}}=\frac{\frac{1000\sqrt{2}}{3\pi^2}}{\frac{500}{3\pi^2}}=2\sqrt{2}$. **(B)**

6. $|x-4|\ge 2$ *and* $|x-4|\le 8$

   $x-4\ge 2 \text{ or } x-4\le -2$ $\quad$ $x-4\le 8 \text{ and } x-4\ge -8$

   $x\ge 6 \text{ or } x\le 2$ $\quad$ $x\le 12 \text{ and } x\ge -4$

   Solution set: $[-4,2]\cup[6,12]$. There are 14 integers in the solution set. **(E)**

7. If $f(x)=\frac{1}{x}$ and $g(x)=x^2-4$, then $f(g(x))=\frac{1}{\left(x^2-4\right)}$. **(D)**
8. $A=\cfrac{10}{3+\cfrac{10}{3+\cfrac{10}{3+\ldots}}}$, so $A=\frac{10}{3+A}$. $3A+A^2=10 \to A^2+3A-10=0 \to (A+5)(A-2)=0 \Rightarrow A=2.$

   $B=\sqrt{210+\sqrt{210+\sqrt{210+\ldots}}}$, so $B=\sqrt{210+B}$. $B^2=210+B \to (B-15)(B+14)=0 \Rightarrow B=15.$

   $\frac{C}{D}=0.3\bar{4}=\frac{31}{90}$. $\quad$ $A=2,\ B=15=3\cdot 5,\ D=2\cdot 3^2\cdot 5.$ LCM = $2\cdot 3^2\cdot 5=90$. **(A)**
9. $\frac{x+4}{x^3-2x^2+x}=\frac{x+4}{x(x-1)^2}=\frac{A}{x}+\frac{B}{x-1}+\frac{C}{(x-1)^2} \to x+4=A(x-1)^2+Bx(x-1)+Cx$.

   $x+4=A(x-1)^2+Bx(x-1)+Cx=Ax^2+Bx^2-2Ax-Bx+Cx+A$.

   $0=A+B,\ 1=-2A-B+C,\ 4=A \Rightarrow (4,-4,5)$. **(B)**
10. The matrix is singular if its determinant is 0. $1(2x-4)-0+2(x-3x)=0 \to 2x-4+2x-6x=0$.

    $-2x=4 \Rightarrow x=-2$. **(A)**

11. According to the Triangle Inequality Theorem, the sum of the two shortest sides must be greater than thelongest side. Since the actual side lengths are unknown, test all three possibilities.
$(3x+4)+(6x-1)>8x+2 \to x>-1$
$(6x-1)+(8x+2)>3x+4 \to x>\frac{3}{11}$ The only solution creating viable side lengths is **(B)**.
$(3x+4)+(8x+2)>6x-1 \to x>-\frac{7}{5}$

12. The center is at (0, 3), so $c=2$. The length of the major axis is 8. Since $2a=8$, $a=4$. Using $a^2=b^2+c^2$, $b^2=12$. $\frac{x^2}{16}+\frac{(y-3)^2}{12}=1 \to 3x^2+4(y-3)^2=48 \to 3x^2+4y^2-24y-12=0$. Multiplying by 4, **(A)** is obtained.

13. The three lines create a right triangular region with vertices $(-2,0)$, $(0,0)$ and $(0,-2)$. Each leg has length 2, so the area is $\frac{1}{2}(2)(2)=2$. **(A)**

14. $F=\frac{kV^2}{R} \to 600=\frac{15^2k}{3} \to k=8 \Rightarrow F=\frac{(8)25^2}{4}=1250$. **(D)**

15. $(15+5)T_1=35 \to T_1=\frac{7}{4}hr$. $(15-5)T_2=35 \to T_2=\frac{7}{2}hr$. $R=\frac{D}{T}=\frac{70}{\frac{7}{4}+\frac{7}{2}}=\frac{70}{\frac{21}{4}}=\frac{280}{21}=13.\bar{3}$. **(E)**

16. $\sqrt{4x+7}\le 4 \to 4x+7\le 16 \to x\le 2.25$. Testing the domain, $4x+7\ge 0 \to x\ge -1.75$. The integers are –1,
0, 1, and 2, the average being 0.5. **(A)**

17. $-4x^2+17x+15\le 0 \to 4x^2-17x-15\ge 0 \to (4x+3)(x-5)\ge 0 \Rightarrow \left(-\infty,-\frac{3}{4}\right]\cup[5,\infty)$. $\left[-\frac{3}{4}\right]=-1$.**(B)**

18. $\left(x^2-6x+4\right)^2=16 \to x^2-6x+4=\pm 4$. If +4, then $x^2-6x=0 \to x=0,6$. If –4, then $x^2-6x+8=0 \to (x-4)(x-2)=0 \to x=2,4$. $0+6+2+4=12$. **(E)**

19. $\frac{x^2-4}{x^2-1}\le\frac{x}{x+3} \to \frac{3\left(x^2-x-4\right)}{(x+1)(x-1)(x+3)}\le 0$. The critical values are $x=-3,\frac{1\pm\sqrt{17}}{2},-1,1$. Using $\sqrt{17}\approx 4.1$ and performing a +/- analysis, it is found that the most positive value of x is $\frac{1+\sqrt{17}}{2}$. **(D)**

20. $2^{x+3}=3^{2x-1}\to 2^x2^3=3^{2x}3^{-1}\to 24=\dfrac{3^{2x}}{2^x}=\dfrac{9^x}{2^x}=\left(\dfrac{9}{2}\right)^x\to \log 24=x\log\left(\dfrac{9}{2}\right)\Rightarrow x=\dfrac{\log 24}{\log\left(\dfrac{9}{2}\right)}$. **(B)**

21. $3^x4^y=15{,}552=243\cdot 64=3^5\cdot 4^3\Rightarrow 5+3=8$ **(C)**

22. $3^{5x}\bullet 81^{-x}\ge 9^{x^2-3}\to 3^{5x}3^{-4x}\ge 3^{2x^2-6}\to x\ge 2x^2-6\to 2x^2-x-6\le 0\to(2x+3)(x-2)\le 0$.
$\left[-\dfrac{3}{2},2\right]\to -1,0,1,2$. Positive integers are 0, 1, 2, so **(C)**.

23. $w=17+2(3)+\left[\dfrac{3(3+1)}{5}\right]+1973+\left[\dfrac{1973}{4}\right]-\left[\dfrac{1973}{100}\right]+\left[\dfrac{1973}{400}\right]+2$
$\to 17+6+[2.4]+1973+[493.25]-[19.73]+[4.9325]+2$ =23 + 2 + 1973 + 493 – 19 + 4 + 2 =354.
$2473\div 7=354R0$,so Saturday **(D)**.

24. Using synthetic division, $\begin{array}{r|rrr} 4 & 1 & -11 & 30 \\ & & 4 & -28 \\ \hline & 1 & -7 & 2 \end{array}\Rightarrow y=x-7$ **(B)**

25. Using the factors of 32 (*p*) and the factors of 16 (*q*), $\dfrac{p}{q}$ could be any of the choices given, so **(E)**.

26. The point (0, 7) is on the line $y=\dfrac{1}{2}x+7$. Find the equation of a line that passes through (0, 7) and is perpendicular to $y=\dfrac{1}{2}x+7$. That line is $y=-2x+7$. The lines $y=-2x+7$ and $2y=x+6$ intersect at $\left(\dfrac{8}{5},\dfrac{19}{5}\right)$. The distance between $\left(\dfrac{8}{5},\dfrac{19}{5}\right)$ and (0, 7) is $\dfrac{8\sqrt{5}}{5}$. **(A)**

27. $3y+9=-2x\to 3y=-2x-9\to y=-\dfrac{2}{3}x-3.\ m=-\dfrac{2}{3}$, so $m_\perp=\dfrac{3}{2}$. **(C)**

28. $f(x+1)-f(x)=|3(x+1)+1|-5-\left(|3x+1|-5\right)=|3x+4|-|3x+1|$. **(D)**

29. $f(x)=y=\sqrt{2x-1}\Rightarrow x=\sqrt{2y-1}\to x^2=2y-1\to y=\dfrac{x^2+1}{2}$. **(A)**

30. Let *k* be the proportionality constant. If $4k=c$, $bk=-7$, and $ck=16$, then $k=\dfrac{c}{4}$, $k=-\dfrac{7}{b}$, and $k=\dfrac{16}{c}$. Now, $\dfrac{c}{4}=\dfrac{16}{c}$, so $c=\pm 8$. If $c=8$, $k=2$ and $b=-\dfrac{7}{2}$; if $c=-8$, $k=-2$ and $b=\dfrac{7}{2}$. There are two values for *b* and *c*, so **(C)**.