Answers:

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

Solutions:

1. The given line has slope $3/2$, so the perpendicular line has slope $-2/3$, and since it goes through the point $(-2,3)$, the line has equation $y-3=-2/3(x+2)$ $\Rightarrow 3(y-3)=-2(x+2)\Rightarrow 2x+3y=5$.

2.
$$\begin{array}{r|rr|r} & -1 & 4 & \\ 8 & 2 & 5 & -5 \\ 20 & 4 & -3 & -6 \\ 3 & -1 & 4 & 16 \\ 31 & & & 5 \end{array} \Rightarrow A=\frac{1}{2}\left|31-5\right|=13$$

3. $f(2)=3\Rightarrow 4a-2b+c=3$, and $x=-3$ is a zero$\Rightarrow 9a+3b+c=0$. Subtracting the first equation from the second equation gives $5a+5b=-3\Rightarrow a+b=-3/5$.

4. Setting the two functions equal gives $|x-1|=2x+2\Rightarrow x^2-2x+1=4x^2+8x+4\Rightarrow$ $0=3x^2+10x+3=(3x+1)(x+3)\Rightarrow x=-1/3$ or $x=-3$. The only value that makes $2x+2>0$, though, is $x=-1/3$.

5. $g(3)-f(1)=2f(3)-3f(2)-f(1)=2\cdot 5-3\cdot 1-(-1)=8$

6. $3^{4-x}=9\left(3^{x^2-2x}\right)=3^{x^2-2x+2}\Rightarrow 4-x=x^2-2x+2\Rightarrow 0=x^2-x-2=(x-2)(x+1)$, so both roots are real and their sum is 1. $2^{3y-1}=4^{y^2}=2^{2y^2}\Rightarrow 3y-1=2y^2\Rightarrow 0=2y^2-3y+1$ $=(2y-1)(y-1)$, so both roots are real and their sum if $3/2$. $1\left(3/2\right)=3/2$

7. $x=\sqrt{3+\sqrt{3+\sqrt{3+\ldots}}}\Rightarrow x=\sqrt{3+x}\Rightarrow x^2-x-3=0\Rightarrow x=\frac{1+\sqrt{13}}{2}$ (since $x>0$). $y=\sqrt{2+\sqrt{2+\sqrt{2+\ldots}}}\Rightarrow y=\sqrt{2+y}\Rightarrow y^2-y-2=0\Rightarrow y=2$ (since $y>0$). $x-y=$ $\frac{1+\sqrt{13}}{2}-2=\frac{-3+\sqrt{13}}{2}$, so $a+b-c=-3+13-2=8$.

8. There are 8 possible sequences of three coin tosses, and there are 3 possible tosses of 2 heads and 1 tail (the tail could be any of the three tosses). The odds, then, are 3:5.

9. $x=\frac{f^{-1}(x)-1}{f^{-1}(x)+2}\Rightarrow xf^{-1}(x)+2x=f^{-1}(x)-1\Rightarrow 2x+1=f^{-1}(x)(1-x)\Rightarrow f^{-1}(x)=\frac{2x+1}{1-x}$

10. $f(x)=2x^2-5x-8=2\left(x-\frac{5}{4}\right)^2-\frac{89}{8}$, so the minimum value is $-\frac{89}{8}=-11.125$

11. $c=\log_a\frac{3}{b}\Rightarrow a^c=\frac{3}{b}\Rightarrow b=\frac{3}{a^c}$

12. Since $f^{-1}(2)=3$, $a=f(3)=2$. Also, since $f(1)=3$, $b=f^{-1}(3)=1$. $a+b=2+1=3$

13. $4!=24$

14. $\sum_{c=2}^{7}\frac{1}{c+1}-\sum_{c=2}^{7}\frac{1}{c-1}=\frac{1}{7}+\frac{1}{8}-\frac{1}{2}-1=\frac{8+7-28-56}{56}=-\frac{69}{56}$

15. $AB=(A+2.5)\left(B-\frac{2}{3}\right)\Rightarrow 0=2.5B-\frac{2}{3}A-\frac{5}{3}$ and $AB=(A-2.5)\left(B+\frac{4}{3}\right)\Rightarrow$ $0=-2.5B+\frac{4}{3}A-\frac{10}{3}$. Adding these two equations together gives $0=\frac{2}{3}A-5\Rightarrow$ $A=\frac{15}{2}$. Plugging that back in gives $B=\frac{8}{3}$, so $AB=\frac{15}{2}\cdot\frac{8}{3}=20$.

16. To have the appropriate sum and product of roots, Joe's equation would be $0=2x^2-3x-2=(2x+1)(x-2)$, so the roots are 2 and $-\frac{1}{2}$.

17. $\sqrt[3]{27-54\cdot 4+36\cdot 4^2-8\cdot 4^3}=\sqrt[3]{-125}=-5$

18. Let $f(x)=ax^2+bx+c$. $c=f(0)=4$, $5=f(1)=a+b+4\Rightarrow a+b=1$, and $9=f(-1)$ $=a-b+4\Rightarrow a-b=5$. Therefore, $a=3$ and $b=-2$, making $f(x)=3x^2-2x+4\Rightarrow$ $f(5)=3\cdot 5^2-2\cdot 5+4=75-10+4=69$.

19. $9x^2+9y^2-54x+36y=-101\Rightarrow 9(x-3)^2+9(y+2)^2=16\Rightarrow(x-3)^2+(y+2)^2=\frac{16}{9}$, so $A=\frac{4}{3}$. $25x^2+9y^2+100x-90y=-100\Rightarrow 25(x+2)^2+9(y-5)^2=225\Rightarrow$ $\frac{(x+2)^2}{9}+\frac{(y-5)^2}{25}=1$, so $B=2\cdot 5=10$. $3A-2B=3\left(\frac{4}{3}\right)-2(10)=4-20=-16$

20. Graphing the system, there are 4 points with $y=1$: $x=1, 2, 3, 4$; 4 points with $y=2$: $x=1, 2, 3, 4$; 3 points with $y=3$: $x=1, 2, 3$; 2 points with $y=4$: $x=1, 2$; and 1 points with $y=5$: $x=1$. Therefore, there are 14 points (this could also be done with Pick's Theorem).

21. $0=z\bar{z}+(-3+4i)\bar{z}+(-3-4i)z=(x^2+y^2)-3x+3yi+4xi+4y-3x-3yi-4xi+4y$
$=x^2-6x+9+y^2+8y+16-25\Rightarrow(x-3)^2+(y+4)^2=25$, so the center is $(3,-4)$.

22. The vertex of this parabola is $\left(\frac{2}{3},-\frac{13}{3}\right)$, so over the domain $x\geq 3$, the graph is increasing. When $x=3, y=12$, so the range of the function, which is the domain of the inverse of the function, is $y\geq 12$, or $[12,\infty)$

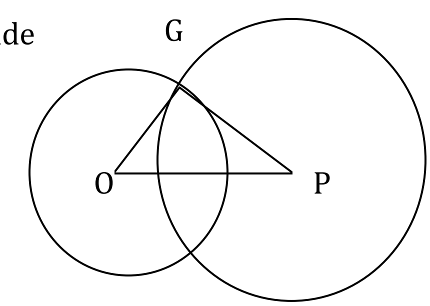
23. $\frac{3i}{i+3}-\frac{i}{i-3}=\frac{3i(3-i)}{10}-\frac{i(-3-i)}{10}=\frac{2+12i}{10}=\frac{1}{5}+\frac{6}{5}i$, so $a+b=\frac{1}{5}-\frac{6}{5}=-1$

24. $\frac{2}{3}=\log_8(x+1)-\log_8(x-1)=\log_8\frac{x+1}{x-1}\Rightarrow 4=\frac{x+1}{x-1}\Rightarrow x=\frac{5}{3}$, so $a^b=5^3=125$.

25. $\begin{bmatrix}2 & 5\\ -2 & -4\end{bmatrix}^{-1}=\frac{1}{2}\begin{bmatrix}-4 & -5\\ 2 & 2\end{bmatrix}=\begin{bmatrix}-2 & -2.5\\ 1 & 1\end{bmatrix}$, so $AB^{-1}=\begin{vmatrix}-1 & 3\\ 2 & 5\\ 0 & -4\end{vmatrix}\begin{bmatrix}-2 & -2.5\\ 1 & 1\end{bmatrix}=\begin{vmatrix}5 & 5.5\\ 1 & 0\\ -4 & -4\end{vmatrix}$.

26. $0\geq\frac{x-2}{x-3}-2=\frac{-x+4}{x-3}\Rightarrow x<3$ or $x\geq 4$, or in set n

27. Using Hero's formula, the area of $\triangle GOP$ is $\sqrt{9\cdot 4\cdot 3\cdot 2}=6\sqrt{6}$, so the length of the altitude to side OP is $\frac{2\cdot 6\sqrt{6}}{7}=\frac{12\sqrt{6}}{7}$. Therefore, the length of GH is double that altitude, or $\frac{24\sqrt{6}}{7}$.



28. $7x^2-74=\begin{vmatrix}-2 & 4 & 0\\ 3 & x & 3\\ -1 & 1 & 5\end{vmatrix}=-10x-12+0-0+6-60\Rightarrow 0=7x^2+10x-8=(7x-4)(x+2)$,

so the largest value of x that works is 4/7.

29. Let x_1 and x_2 be the roots of the equation. Since $x_i^2 = 7x_i - 5$, $x_1^2 + x_2^2 =$ $= 7(x_1 + x_2) - 10 = 7 \cdot 7 - 10 = 39$. If the smaller acute angle is 39°, the larger acute angle is 51°.

30. $3x^2 + 16x + k = -2x^2 - 4x + 6 \Rightarrow 0 = 5x^2 + 20x + (k - 6)$, which has only one x-value when $20^2 - 4(5)(k - 6) = 0 \Rightarrow k - 6 = 20 \Rightarrow k = 26$.