1. 12
2. 19/24
3. 75
4. 205
5. -107
6. 4
7. 463
8. $\frac{x+2}{x-1}$
9. 8
10. 1
11. 3
12. 48/7
13. 3230
14. 5
15. $\frac{2xy}{x+y}$
16. -64
17. 120° or 120
18. 2
19. ($)110
20. 3/8
21. 170
22. 10
23. -14 and 10
24. 64π
25. 0

1. Solve by substitution:

$B = M + 2$ and $\begin{aligned} B+2 &= 2(M-3) \\ B &= 2M-8 \end{aligned}$

$\begin{aligned} M+2 &= 2M-8 \\ 10 &= M \end{aligned}$ so Bill is 12.

2. $\log_8\left(\sqrt{2^{0.75}}\cdot\left(2^6\right)^{1/3}\right) = \log_8 2^{3/8}\cdot 2^2$
$= \log_8 2^{19/8} = \frac{19}{8}\cdot\frac{1}{3} = \frac{19}{24}$

3. $x =$ original total amount in mixture
$0.4x = 0.35x + 15 \Rightarrow x = 300$
$.25x = .25\cdot 300 = 75$

4. A primitive Pythagorean triple has $m^2 - n^2$, $2mn$, and $m^2 + n^2$ as its three sides. Being the odd leg, $(m+n)(m-n) = m^2 - n^2 = 133 = 19\cdot 7$ meaning $m = 13$ and $n = 6$ (these numbers do make the other leg 156, so the hypotenuse has length $13^2 + 6^2 = 169 + 36 = 205$.

5. $-3(2)^5 + 3(2)^4 - 9(2)^3 + (2)^2 + 2(2) + 5$
$= -96 + 48 - 72 + 4 + 4 + 5 = -107$

6. QQNNNQ

QNQNNQ

QNNQNQ

QNNNQQ

7. LCM of 6, 7, and 11 is 462, so

1+462=463.

8.
$$\begin{aligned} f(x) &= \frac{x+2}{x-1} \\ x &= \frac{y+2}{y-1} \\ xy - x &= y+2 \\ xy - y &= x+2 \\ y(x-1) &= x+2 \\ y &= \frac{x+2}{x-1} \\ f^{-1}(x) &= \frac{x+2}{x-1} \end{aligned}$$

9. The largest median will occur when the 3 missing integers are greater than or equal to 9 so the list of all 9 numbers is

3, 5, 5, 7, 8, 9, x, y, z and thus the largest possible median is 8.

10.
$$2(2x-4)-(3x-6)=8+3(4-7x)$$
$$4x-8-3x+6=8+12-21x$$
$$x-2=20-21x$$
$$22x=22$$
$$x=1$$

11. How m**A**ny "**A**"'s **A**re in this sentence?

12.
$$m=\frac{8-6}{4-(-3)}=\frac{2}{7}$$
$$y=mx+b$$
$$6=\frac{2}{7}(-3)+b$$
$$b=6+\frac{6}{7}=\frac{48}{7}$$

13. The last digit must be 0 since having 2 or 3 3's would be too many digits, and having a 1 as the last digit would require a 3 elsewhere, and it would have to be the second digit, except that that would require all other digits to be 1, which is contradictory.

Therefore, no digit is a 3.

If the first digit, which can't be 0, was a 2, then the second digit must be a 0 (the third digit couldn't be a 0), and then the third digit could be a 2 and this number work, so 2020 is one of the two integers.

If the first digit was a 1, the second digit must be a 2 (it can't be a 1), and then the third digit could be a 1 and this number work, so 1210 is the other integer.

The sum of the integers is 2020 + 1210 = 3230.

14.
$$x^2+4x+55=100$$
$$x^2+4x-45=0$$
$$(x+9)(x-5)=0$$

so $x=5$ is the positive root.

15. Average speed = Total Distance/Total Time

$$\frac{2}{\frac{1}{x}+\frac{1}{y}} = \frac{2}{\frac{y+x}{xy}} = \frac{2xy}{x+y}$$

16. $(1+i)^{12} = (2i)^6 = 64i^6 = -64$

17. For $\angle x$,

$$\begin{aligned}(180-x) &= 5x\\ 180 &= 6x\\ 30 &= x\end{aligned}$$

the complement would be 60° and twice the complement would be 120°.

18.

$$\begin{aligned}&1+1\cdot1+1-1\div1-1\cdot1\cdot1+1\\ &=1+1+1-1-1+1=2\end{aligned}$$

19.

$$\begin{aligned}\frac{4}{5}\left(\frac{3}{4}x\right) &= \$66\\ \frac{3}{5}x &= 66\\ x &= 110\end{aligned}$$

20. Since there are two options for each child, there are 8 possible sequences of sex for the three children. Two boys means one girl, and there are three positions for the girl's birth in the birth order, so the probability is 3/8.

21. Number of diagonals $= \frac{n(n-3)}{2}$

$$\frac{20(20-3)}{2} = \frac{20\cdot17}{2} = 170$$

22. $c+a=25$ and $4c+6a=130$

Solve by substitution:

$$\begin{aligned}a &= 25-c\\ 4c+6a &= 130\\ 4c+6(25-c) &= 130\\ 4c+150-6c &= 130\\ -2c &= -20\\ c &= 10\end{aligned}$$

23.
$$\frac{|2p+4|}{8}=3$$
$$2p+4=\pm 24$$

$$2p+4=24$$
$$2p=20$$
$$p=10$$

$$2p+4=-24$$
$$2p=-28$$
$$p=-14$$

24. The radius of the regular hexagon is equal to the length of the side (8) and is also the radius of the circumscribed circle so area is $\pi(8)^2=64\pi$.

25. The 3 slopes are $-\sqrt{3}, 0, \sqrt{3}$
$$-\sqrt{3}+0+\sqrt{3}=0$$