(1)

$\boxed{D}$ See Question 3

(2)

The solution to the cryptarithm is:

```
   775
   x33
  2325
2325
25575
```

The sum of all of these digits is 73. $\boxed{C}$

(3)

Question 2 does not have answer choice (a) so the answer is not (b). If Question 3 were the first question with choice (a) then its answer would be (a) not (c) so (c) is not correct. If Question 1 had an answer choice of (a), then (c) would be the only repeated answer in the first four questions. But then Question 3 would have answer choice (a) so (c) wouldn't be the only repeated answer. Therefore the answer to this question is (d) or (e). If the answer is (e) then there are no questions with (a) as an answer among the first four. Therefore Question 1 has neither (a) nor (c) as an answer. If Question 1 has (b) as an answer, then the only repeated answer is (e), which means the answer to Question 4 must be (e). Question 4 cannot be (d) or (e) since they are self-contradictory. If Question 1 has (e) as the correct answer, there must be two questions with (b) as an answer but neither Questions 1, 2, or 3 could have (b) as an answer in this scenario. Therefore Question 1 has (d) as an answer, so there must be at least one other question with answer choice (d). But Question 2 and 4 cannot have (d) as an answer, so Question 3 must have (d) as an answer. This forces Question 4 to have (a) as an answer. $\boxed{D}$

(4)

$\boxed{A}$ See Question 3

(5)

The solution to the sudoku is:

| | | | | | |
|---|---|---|---|---|---|
| 1 | 3 | 5 | 4 | 6 | 2 |
| 6 | 4 | 2 | 5 | 1 | 3 |
| 4 | 1 | 6 | 3 | 2 | 5 |
| 5 | 2 | 3 | 1 | 4 | 6 |
| 3 | 6 | 1 | 2 | 5 | 4 |
| 2 | 5 | 4 | 6 | 3 | 1 |

So the sum of the positive diagonal is 17. $\boxed{A}$

(6)

$\boxed{C}$ See for example :

https://artofproblemsolving.com/wiki/index.php/1955_AHSME_Problems/Problem_38

(7)

These are the Sophie Germain primes, the prime numbers for which 2p+1 is also a prime number. The missing prime is 41. $\boxed{B}$

(8)

$\boxed{B}$ See for example :

https://artofproblemsolving.com/wiki/index.php/1961_AHSME_Problems/Problem_37

(9)

$\boxed{A}$ See for example :

https://artofproblemsolving.com/wiki/index.php/1964_AHSME_Problems/Problem_40

(10)

$\boxed{D}$ See for example :

https://artofproblemsolving.com/wiki/index.php/1965_AHSME_Problems/Problem_40

(11)

$\boxed{A}$ See for example :

https://artofproblemsolving.com/wiki/index.php/1966_AHSME_Problems/Problem_16

(12)

None of these are concludable. $\boxed{E}$

(13)

$\boxed{D}$ See for example :

https://artofproblemsolving.com/wiki/index.php/1981_AHSME_Problems/Problem_26

(14)

$\boxed{D}$ See for example :

https://artofproblemsolving.com/wiki/index.php/1982_AHSME_Problems/Problem_30

(15)

This is encoded using the Playfair cipher, with the key provided in the corner. When decoded it reads
WHICHOFTHEFOLXLOWINGNAMESISBESTASXSOCIATEDWITHDAVINCIX

Removing the Xs, we get "Which of the following names is best associated with Da Vinci" and the obvious answer is Leonardo. $\boxed{B}$

(16)

$\boxed{B}$ See for example :

https://artofproblemsolving.com/wiki/index.php/1986_AHSME_Problems/Problem_12

(17)

Applying the first condition, we remove all multiples of six from outside 40-49:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 |
| ~~60~~ | 61 | 62 | 63 | 64 | 65 | ~~66~~ | 67 | 68 | 69 |
| 80 | 81 | 82 | 83 | ~~84~~ | 85 | 86 | 87 | 88 | 89 |

Next we remove all non-multiples of 7 from the first and third row:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ~~40~~ | ~~41~~ | 42 | ~~43~~ | ~~44~~ | ~~45~~ | ~~46~~ | ~~47~~ | ~~48~~ | 49 |
| ~~60~~ | 61 | 62 | 63 | 64 | 65 | ~~66~~ | 67 | 68 | 69 |
| ~~80~~ | ~~81~~ | ~~82~~ | ~~83~~ | ~~84~~ | ~~85~~ | ~~86~~ | ~~87~~ | ~~88~~ | ~~89~~ |

Finally we remove all non-multiples of 8 from the first and second rows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ~~40~~ | ~~41~~ | ~~42~~ | ~~43~~ | ~~44~~ | ~~45~~ | ~~46~~ | ~~47~~ | ~~48~~ | ~~49~~ |
| ~~60~~ | ~~61~~ | ~~62~~ | ~~63~~ | 64 | ~~65~~ | ~~66~~ | ~~67~~ | ~~68~~ | ~~69~~ |
| ~~80~~ | ~~81~~ | ~~82~~ | ~~83~~ | ~~84~~ | ~~85~~ | ~~86~~ | ~~87~~ | ~~88~~ | ~~89~~ |

64 is the only option left. $\boxed{B}$

(18)

$\boxed{C}$ See for example :

https://artofproblemsolving.com/wiki/index.php/1991_AHSME_Problems/Problem_18

(19)

$\boxed{B}$ See for example :

https://artofproblemsolving.com/wiki/index.php/1993_AHSME_Problems/Problem_1

(20)

$\boxed{D}$ See for example :

https://artofproblemsolving.com/wiki/index.php/2003_AMC_10A_Problems/Problem_20

(21)

$\boxed{C}$

Let $B$ be the number of blue marbles initially in the bag and $R$ be the number of red marbles initially within the bag. Then if we add $X$ red marbles we have $\frac{B}{B+R+X} = \frac{1}{3}$ and $R + X = 3R \to X = 2R \to \frac{B}{B+3R} = \frac{1}{3} \to 3B = B + 3R \to 2B = 3R \to 5B = 3(B+R) \to \frac{B}{B+R} = \frac{3}{5}$.

(22)

$\boxed{A}$ See for example :

https://artofproblemsolving.com/wiki/index.php/2007_AMC_10A_Problems/Problem_20

(23)

$\boxed{A}$ See for example :

https://artofproblemsolving.com/wiki/index.php/2009_AMC_12A_Problems/Problem_8

(24)

Bertrand Russell never won a Fields Medal $\boxed{C}$

(25)

$\boxed{C}$ See for example :

https://artofproblemsolving.com/wiki/index.php/2010_AMC_10B_Problems/Problem_13

(26)

$\boxed{D}$ See for example :

https://artofproblemsolving.com/wiki/index.php/2014_AMC_10A_Problems/Problem_8

(27)

$\boxed{C}$ See for example :

https://artofproblemsolving.com/wiki/index.php/2018_AMC_10A_Problems/Problem_8

(28)

$\boxed{B}$ See for example :

https://artofproblemsolving.com/wiki/index.php/2019_AMC_10A_Problems/Problem_21

(29)

$\boxed{A}$ See for example :

https://artofproblemsolving.com/wiki/index.php/2023_AMC_10B_Problems/Problem_6

(30)

$\boxed{A}$ See for example :

https://artofproblemsolving.com/wiki/index.php/2024_AMC_10A_Problems/Problem_1

**ANSWERS**

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