MSMA 1 20-21 Explanations
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1. B
39 + 67 = 106

2. D
71 - 48 = 23

3. A
27 × 44 = 1188

4. B
713 ÷ 31 = 23

5. E
Use the distributive property to expand this into an equivalent expression (multiply each term by the outside number)
3(m + n) = 3m + 3n

6. B
Roman Numerals
I=1
V=5
X=10

L=50
C=100
D=500
M=1000

Special rules:
When a smaller number is before a bigger number subtract the small number from the bigger (ex. IV = 4, since the 1 is smaller than the 5)

In all other cases simply add all the numbers together
67 = LXVII (50, 10, 5, 2)

7. C

The shape is irregular, but you can split into separate shapes in order to calculate the area. There are multiple ways to do this, and the one used here is just one solution.

Split the shape with a vertical line at the angle created by the perpendicular lines.

Now there are two rectangles.

Calculate the areas of these rectangles (find their respective sides) and add together for the total area of the shape.

$9 \times 5 + 11 \times (13 - 9) = 89$

8. A

This should be easy enough to add together, but if you want to simplify it use distributive property.

$2 (1 + 2 + 3 + 4) + 5 = 25$

9. E

Convert 15% to a decimal in order to multiply it with 90. Remember that percentages can be converted to decimal by moving decimal point two to the right.

$15\% = 0.15$

$0.15 \times 90 = 13.5$

10. D

Remember that the x-axis is right-left and y-axis is up-down. Right and up are positive, left and down are negative.

(-6,11) moved six to the left and 4 upwards.

x-coordinate is $-6 - 6 = -12$

y-coordinate is $11 + 4 = 15$

A is (-12, 15)

Sum is 3

11. A

Mode is the most frequently occurring number in a set of numbers. So just count how many times each number occurs and the one with the highest count is mode.

Mode is 45

12. C
LCM (Least common multiple) is the smallest number that is divisible by both numbers. An easy way to solve for this would be to find the GCD (Greatest common divisor) and divide one number by the GCD. Next, multiply the remaining two numbers together.
(The GDC is the largest number that divides both numbers)

GCD is 2 so divide either of the two numbers by 2
$30 \div 2 = 15$
Then multiply them together
$124 \times 15 = 1860$

13. C
A palindrome is a number that reads the same forwards or backwards. Find the largest one smaller than 732.
Answer is 727

14. D
A cube has 6 faces, so there are 6 different outcomes after rolling a die. The question is asking for the probability that the number facing up is a multiple of 3, so find which of the numbers are divisible by 3.
Numbers: 3, 6, 9, 12
4 out of the 6 numbers are divisible by 3
$4/6 = 2/3$
Answer : ⅔

15. B
Prime factorization is the decomposition of a composite number into a product of its prime integers.
There is a method in order to find this, but the simplest way is to just try each of the answers, and see if they multiply to 714

$714 = 2 \times 3 \times 7 \times 17$

16. A
Plug the given variable into the equation. The | | symbols mean absolute value which means they turn the expression inside positive.
$|4 \times (-19) - 3| - 2 = |-76 - 3| - 2 = |-79| - 2 = 79 - 2 = 77$

17. A
A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10.
$540{,}000 = 5.4 \times 10^5$

18. E
Use basic arithmetic operations to solve.
$(4 \times (\$0.65)) + (3 \times (\$1.99)) + (2 \times (\$1.19)) = \$2.60 + \$5.97 + \$2.38 = \$10.95$
Subtract the total price from $20 to find the change.
$\$20 - \$10.95 = \$9.05$

19. B
The total amount of degrees in a triangle is always 180.
To find x, subtract the other two angles from 180
$180 - (41 + 118) = 21$

20. C
In the problem it states $m \odot n = -123 - (m) \times (n)$
So $-6 \odot 14 = -123 - (-6) \times (14) = -123 - (-84) = -123 + 84 = -39$

21. C
Calculate the amount given and add to the original amount.
7 nickels + 5 quarters + 3 dimes + 6 pennies = $0.35 + $1.25 + $0.30 + $0.06 = $1.96
$\$14.72 + \$1.96 = \$16.68$

22. A
Remember that the hypotenuse is the largest side of a right triangle (use the formula $a^2 + b^2 = c^2$ where a and b are legs and c is hypotenuse)
The sides given form a common 5, 12, 13 triangle
$5^2 + x^2 = 13^3$
$25 + x^2 = 169$
$x^2 = 169 - 25 = 144$
$x = 12$
The longest leg would be 12 which is also the length of the side of the square.
Perimeter of square is $4 \times s$ so $4 \times 12 = 48$

23. D
Remember 1 foot = 12 inches
Use proportion for foot to inches
$252 \div 12 = 21$ ft

24. D
To convert a number in a specific base to base 10, multiply each digit in the number by the base from right to left while increasing in power (starting from 0) and add.
54 (base 7)
Units digit : $4 \times 7^0 = 4$
Tens digit : $5 \times 7^1 = 35$
Add : $35 + 4$

25. D
When figuring out how many zeros are at the end of a number, find how many pairs of (2×5) are present.
$8^3 \times 5^6$
Notice that the 8 can be turned into 2^3
$(2^3)^3 \times 5^6 = 2^9 \times 5^6$
There are 6 pairs of (2×5)

26. D
An angle and its supplement will add to 180°
Subtract angle A from 180° to get its supplement
180° - 37.34° = 142.66°

27. A
Find what percent 4 is of 16
4/16 = .25
.25 = 25%

28. E
Quadrant 1 is top right (+, +)
Quadrant 2 is top left (-, +)
Quadrant 3 is bottom left (-, -)
Quadrant 4 is bottom right (+, -)
If the line passes through third and first then it must slant upwards as it grows from left to right.
Slope is positive

29. C
Find the number of possibilities for each of the three remaining spaces.
2nd character has to be a letter (26 letter possibilities)
3rd and 4th have to be a number (10 number possibilities)
$26 \times 10 \times 10 = 2600$

30. A
Count each path only moving down or right. Make sure to use all line possibilities without repeating.
The best way to make sure you don't double count is to come up with some order to count the paths in, you can try always taking the right path first, taking the longest path first, it doesn't really matter as long as it helps you tell if you've done a path already

Total of 6 line paths

31. A
Midpoint is calculated by finding the average of the two respective points (x, y)
x-coordinate $(14 - 10) \div 2 = 2$
y-coordinate $(28 + 12) \div 2 = 20$
Midpoint is (2, 20)

32. E
Volume of a cube is calculated by taking the third power of a side.
$11^3 = 1331$

33. B
The median of a box and whisker plot is the middle line.
Median is 26
$26 + 12 = 38$

34. E
Perform the function by plugging the given x value into the equation.
$f(-6) = 13 - 2(-6)^2 = 13 - 72 = -59$

35. B
Use proportion to calculate the probability.
$30\% / 100\% = 24 / x$
$x = (24 \times 100) \div 30 = 80$

36. D

The imaginary number *i* describes the square root of -1 **($\sqrt{-1}$)** and there are only four possibilities of its powers.

First Power **(i^1)** = i
Second Power **(i^2)** = -1
Third Power **(i^3)** = -i
Fourth Power **(i^4)** = 1

These are the only powers you need to remember. These are the only four outcomes of a power of i. Any powers of *i* afterwards will be a multiple of the number. An easy way of determining what your number will equal is dividing your exponent by 4, and your remainder will be which power of *i* the number will be.
$i = i^5$

37. D
Distribute the equation by multiplication.
$(x - 7)(x + 8) = x^2 + 8x - 7x - 56 = x^2 + x - 56$

38. D
Simplify each equation to see if they have possible solutions or not.
A. $3x + 14 = 4 + 2x$
$x = -10$ (valid)

B. $\frac{1}{2}(8 - 6x) = 3x + 1$
$-3x + 4 = 3x + 1$
$-6x = -3$
$x = \frac{1}{2}$ (valid)

C. $2x = 0$
$x = 0$ (valid)

D. $5x = \frac{1}{2}(3 + 10x)$
$5x = 5x + 3/2$
$0 = 3/2$ (invalid)

E. $-x = -2x$
$x = 0$ (valid)

39. A

Two numbers are relatively prime if there is no integer greater than one that divides them both (their greatest common divisor is one). Count how many numbers don't have a common divisor greater than 1 with 24 ($0 < A < 24$).

1, 5, 7, 11, 13, 17, 19, 23

8 numbers relatively prime

40. B

Adding bases in base n (n is your base number) has the same concept as normal addition. Add numbers as you would normally, but now the maximum number you can write down is n-1 (where n is your base). We normally do math in base 10 and carry the number over if it is greater than 10. In a different base, carry when the number goes over that specific base.

52 (base 6) + 14 (base 6)

2 + 4 = 6 (6 is greater than 6-1, so write down 6-6 = 0, and carry a 1)

5 + 1 (+ 1) = 7 (6 is greater than 6-1, so write down 7-6 = 1, and carry a 1)

Answer : 110

41. C

Simplify the number in the parentheses and multiply.

$\sqrt{8}(4\sqrt{2} + 4\sqrt{18}) = 2\sqrt{2}(4\sqrt{2} + 12\sqrt{2})$

$2\sqrt{2} \times 16\sqrt{2} = 32 \times 2 = 64$

42. E

Simple interest is calculated by using the formula $I = Prt$ (P is principal or the amount, r is the rate of interest, t is time in years)

$\$1200 \times 0.07 \times 0.5 = \$42$

43. B

The exterior angles of any shape always measure up to be 360°. Divide 360 by the number of sides to find the measure of one exterior angle.

$360° \div 8 = 45°$

44. A

The formula $(x - a)^2 + (y - b)^2 = r^2$ is the formula of a circle. The coordinates of the center of a circle are (a, b).

The equation they gave was $(x - 23)^2 + y^2 = 225$

Coordinates of circle's center is (23, 0)

45. B
Remember that absolute value will have two results.
$-4 |5x - 10| = -96$
Divide both sides by (-4)
$|5x - 10| = 24$
(two results, one positive, one negative)
$5x - 10 = 24$
$5x = 34$
$x = 34/5$
And
$5x - 10 = -24$
$5x = -14$
$x = -14/5$
Solve for the sum: $34/5 - 14/5 = 20/5 = 4$

46. E (TMSCA gave wrong answer)
The formula for the axis of symmetry can be found using the equation $-2a / b$ (in the equation $ax^2 + bx + c$). In this situation, there is no b variable meaning $b = 0$, so the axis of symmetry is $x = 0$.

47. E
The altitude (height) of an equilateral triangle is half of the side length multiplied by $\sqrt{3}$.
$(32 \div 2)\sqrt{3} = 16\sqrt{3}$
(This is because half of the side length, and the altitude form a 30,60,90 triangle)

48. C
Simply add each corresponding number in the matrices (top left + top left etc.)
(A full explanation can be found on the last page of the test)

49. E
There are several ways to do this problem. The one shown below is elimination.
$4x - y = 24$
$y - 2x = 16$
Add the two equations together to eliminate y
$2x = 40$
$x = 20$
Plug x into the equation to find y
$4(20) - y = 24$
$-y = 24 - 80$
$y = 56$
$y - x = 56 - 20 = 36$

50. D

Simply Multiply and divide all the terms

(A full explanation can be found on the last page of the test)