MSMA 2 20-21 Explanations

Contributors: Andrew Mi

1. A
4.5 + 19.8 = 24.3

2. E
27.1 - 6.6 = 20.5

3. E
1.9 × 84 = 159.6

4. C
51.2 ÷ 3.2 = 16 (can move decimal point to right to simplify)

5. A
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
XLIX = 49 (XL is 40, IX is 9)

6. D
Count every shape that is formed by three sides.
Triangles are bottom right, top, and the entire shape.
Answer is 3

7. C
Range is calculated by subtracting the smallest number from the largest number in a set of numbers.

143 - 11 = 132

8. E
Use proportion to solve by setting the equation given into numbers.
32/100 = 16/x
1600 = 32x
x= 50

9. B
Use distributive property to simplify expression (divide each term by 2).
½ (8a - 10b) = 4a - 5b

10. C
Divide the perimeter by 4 to find side length, then square that result to find area.
52 ÷ 4 = 13
13^2 = 169 in^2

11. B
Ratio is losses to wins.
(18 - 16) : 16 = 2 : 16 = 1 : 8

12. E
Unit rate is the price of one ticket. Divide by 4 to find.
$49.40 ÷ 4 = $12.35

13. C
An easy trick to find the number of factors: calculate prime factorization of the number; find powers of each factor; add 1 to each power and multiply together. Find prime factorization by continuously dividing the number by its smallest prime factor until it cannot be factored any further.
220 prime factorization : $2^2 \times 5 \times 11$
$(2 + 1) \times (1 + 1) \times (1 + 1) = 3 \times 2 \times 2 = 12$

14. B
This question is just asking which numbers (2, 5, 7, 8, 8) are prime. Remember that prime numbers are numbers that have no divisors besides 1 or itself.

2, 5, 7 are all prime.
3 out of 5 are prime.
60%

15. C
Plug in the given value of n into the equation and solve. Remember that absolute value turns any expression inside positive.
$-16^2 + |-3 \times -16| = 256 + 48 = 304$

16. E
Remember that 1 hour is equal to 60 minutes.
$2.2 \times 60 = 132$ min

17. E
A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. Count how many zeros should be used.
$87{,}000{,}000{,}000 = 8.7 \times 10^{10}$

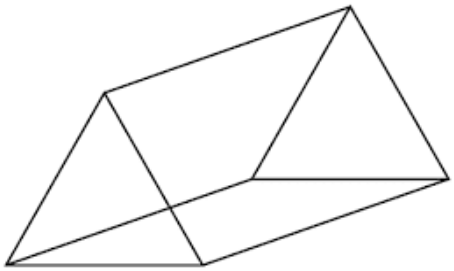
18. A
A rational number is a number that can be written as the quotient of two integers. Observe each number.

√13	The square root of any number that isn't a square number is irrational
-8/5	Is already written as quotient two integers
7.4(repeating)	is equivalent to 67/9 (repeating decimals are rational)
√64	64 is a square number ($8^2 = 64$) so the square root of 64 is rational
25	is rational

Answer is √13

19. A

Remember what a triangular prism looks like and count.



9 edges (3 on each of the triangles, 3 connecting the triangles) + 5 faces = 14

20. C

The cubes with only 2 faces painted blue are all the pieces that are edges, but not corners

8 on the middle front (4 top, 4 bottom), 2 each on the sides (middle, 2 top, 2 bottom), 8 on the middle back (4 top, 4 bottom)
8 + 4 + 8 = 20

21. B
The lower and upper quartiles are represented by the vertical lines at the edge of the box
23 + 28 = 51

22. D
Solve inequality by treating it as a normal algebraic expression.
6 - 2n > 20
-2n > 20 - 6
Remember when you divide inequality by negative number to reverse the sign.
n < 14 ÷ -2
n < -7

23. B
Calculate what percent 24 is of 480.
24/480 = 1/20 = 5%

24. C
In the problem it states a⊗b = (a - b)/2
So just plug in the numbers it gives you.
-22⊗46 = (-22 - 46)/2 = -68/2 = -34

25. A

This is an arithmetic series (addition series of numbers that follow a pattern),
The simplest way to solve this is to use the formula for the sum of consecutive numbers (n(n+1))/2 where n is the largest number, so in this case (20*21)/2 = 210

A more general formula is the Sn formula.
Sn = ((a1 + an) × n) ÷ 2
a1 = first number in the series,
an = last number in the series,
n is = amount of numbers.
(n is calculated by using formula n = ((an - a1) ÷ d) + 1 where d is the difference between numbers)
((1 + 20) × 20) ÷ 2 = 210
You can also add all numbers together (1 to 20) if you forget both formulas.

26. C
To convert a number in base 10 to a number in base n, divide the base 10 number by the base n number and write down the remainder (from right to left). Continue this process until there is nothing left to divide.
104 (base 10) = (base 8)
104 ÷ 8 = 13 remainder 0 (write down 0)
13 ÷ 8 = 1 remainder 5 (write down 5)
1 ÷ 8 = 0 remainder 1 (write down 1)
Answer is 150

27. A
The U symbol means the “union” of the two sets, to find the union simply make a new set with all the elements that are in either of the sets (you don't repeat elements if they appear in both sets)

28. D
Remember that when you rotate a point 90° counterclockwise that (x, y) becomes (-y, x).
Another way would be to find what quadrant your point lies in and what quadrant it will transfer into, and just swap your coordinates.
(3, -4) (4th quadrant) becomes (4, 3) (1st quadrant)

29. B

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 8 line paths

30. E
GCF is the greatest common factor, which is the highest number that evenly divides both numbers. In this situation, separate the variables and constant into different parts to simplify the calculation
.
GCF ($16a^2b$, $48b^2c$)
(Variables a and c only appear in one of the numbers each, so you ignore those)
GCF (16, 48) = 16
GCF (b, b^2) = b
Answer is 16b

31. A
Area of a circle is calculated by using the formula πr^2. The question asks to use 3 as π and gives the diameter of 16 in. Remember that the radius is just half of the diameter.
$\pi r^2 = 3 \times (16 \div 2)^2 = 3 \times 8^2 = 3 \times 64 = 192$ in^2

32. B
A vertical line always has an undefined slope.

33. D
To find the total probability of this, calculate the chance of drawing an O multiplied by the chance of drawing a T.
Chance of drawing O - ⅙ (1 letter O, 6 total letters)
Chance of drawing T - ⅖ (2 letter T's, 5 letters left)
⅙ × ⅖ = 2/30 = 1/15

34. C
Perform addition and subtraction, and make sure to combine correct variables. To make it easier, write x variables together and y variables together.
(6x - 3y) + (5y - 2x) - (2x + y) = (6x - 2x - 2x) + (-3y + 5y - y) = 2x + y

35. A

You can use the an formula (related to #25). an is the term for the last number in a series. Counting is an alternative if you forget the formula. an = d × (n - 1) + a1 (d is the difference between two numbers, n is the amount of numbers, a1 is the first term).
an = 110 × (10 - 1) + 120 = 110 × 9 + 120 = 990 + 120 = 1110

36. C
Direct variation describes the relationship between two variables that can be expressed by an equation in which one variable is equal to a constant times the other. The formula for direct variation is k= y/x. Calculate the variation from the first term and apply to the second.
2/12 = 1/6
5/x will also equal 1/6 because of direct variation
5/x = 1/6 (cross multiply to solve for x)
x = 30

37. E
Calculate all radicals to solve.
$8 + \sqrt{16} + \sqrt[3]{8} = 8 + 4 + 2 = 14$

38. B

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
Answer is **i^3**

39. A
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.
21 (base 4) - 13 (base 4)
Units digit : 1 - 3 (carry 4 to the 1) = 2
Tens digit : 1 - 1 (carried for units already) = 0
Answer is 2

40. C

Calculate the unit price (divide total by pounds) and the lowest number will be the best value.
A. $26.00 ÷ 8 = $3.25/lb
B. $19.68 ÷ 6 = $3.28/lb
C. $22.54 ÷ 7 = $3.22/lb
D. $14.72 ÷ 4 = $3.68/lb
E. $10.05 ÷ 3 = $3.35/lb

41. D
Use the exponent rules to calculate each answer. (add exponents of same base when multiplied, subtract exponents of same base when divided)
The given exponent is m^8
A. $m^{-3-(-11)} = m^8$
B. $m^{9-1} = m^8$
C. $m^{6+2} = m^8$
D. $m^{8-1} = m^7$
E. $m^4 \times^2 = m^8$

42. B
Remember that a Pythagorean Triple is found using the formula $a^2 + b^2 = c^2$. The legs (a and b) would be 17 and 34 and solve for c.
$\sqrt{(17^2 + 34^2)} = 35^2$

43. C
One way to solve this problem would be to set up a system of equations. Set up variables for nickels and quarters and solve. An alternative would be to multiply each possibility until you find the answer.
.25q + .05n = 3.10
q + n = 26
4(.25q + .05n) = 12.40
q + .2n = 12.40
-(q + n) = 26
-.8n = -13.6
n = 17
17 nickels, 9 dimes
17 - 9 =8

44. E
Simply add each corresponding number in the matrices (top left + top left etc.)
(For a full example see question 50 of the Kickoff test)

45. D

Unless you can factor easily and quickly, the best method is to multiply each answer choice out. Remember to multiply out you must FOIL (first, outside inside, last), and multiply every term by both terms on the other number.

A. $2x^2 - 14x + 5x - 35 = 2x^2 - 9x - 35$

B. $2x^2 - 10x + 7x - 35 = 2x^2 - 3x - 35$

C. $2x^2 + 10x - 7x - 35 = 2x^2 + 3x - 35$

D. $2x^2 + 14x - 5x - 35 = 2x^2 + 9x - 35$

E. $2x^2 - 10x - 7x + 35 = 2x^2 - 17x + 35$

46. E

Remember the formula for a triangular prism. (wlh) / 2 (width, length, height). They already provide you with height and length, but you have to solve for width. Use Pythagorean Theorem to find width (notice that it is part of a right triangle).

$\sqrt{(9^2 + b^2)} = 15^2$

$b^2 = 144$

$b = 12$

$9 \times 12 \times 11 \div 2 = 594$

47. D

To rationalize the denominator, multiply the denominator by itself to remove radical. ($\sqrt{24}/\sqrt{24} = 1$ so you are not changing value of the number, but rearranging)

$9 / \sqrt{24} \times \sqrt{24} / \sqrt{24} = 9\sqrt{24} / 24$

Simplify the top

$9\sqrt{(2 \times 2 \times 2 \times 3)} / 24$

$18\sqrt{6} / 24 = 3\sqrt{6} / 4$

48. A

Coordinates are (x, y) value. To find the x value, use the formula -b/2a (in the equation $y = ax^2 + bx + c$), and plug in the x value to find the y value.

$x = -b/2a = -16/8 = -2$

Plug in

$y = 4(-2)^2 + 16(-2) = 16 - 32 = -16$

Add together for sum of coordinates.

$-2 + (-16) = -18$

49. A

Geometric mean is calculated by multiplying numbers together and taking the nth root of the result

(for example for two numbers the square root, 3 numbers cube root, 4 numbers 4th root ect.)

$\sqrt{(1 \times 256)} = 16$

50. C

First, we must solve the equation $-3|2n - 3| = -15$ by dividing both sides of the equation by -3. This gives us $|2n - 3| = 5$. To solve an absolute value equation, we must set what is inside the absolute symbol equal to ±5. These equations are then $2n - 3 = 5$ and $2n - 3 = -5$.

$2n - 3 = 5$ is $2n = 8$ is $n = 4$

$2n - 3 = -5$ is $2n = -2$ is $n = -1$

Multiply together to find the product.

$4 \times (-1) = -4$