2022 MAΘ NATIONAL CONVENTION
MENTAL MATH TEST

ANSWERS

1) 22020

2) 75

3) 13216

4) 14

5) $\frac{5}{4}$

6) 5

7) $\frac{7}{297}$

8) 6

9) 300π

10) 58

11) 67

12) -3

13) 20

14) 5

15) 50

16) alphabetically

17) 25

18) 2, 5, 11

19) 7560

20) 91

21) 2450

22) 89

23) 4:3 or $\frac{4}{3}$

24) $\frac{8}{81}$

25) 4

26) singular or cannot be determined

27) 460

28) 122

29) circle

30) 3,628,800

31) 2

32) 41

33) 26,400

34) 500,500

35) $\frac{11}{8}$

36) 11

37) 30,240

38) 316

39) December 31

40) 1

SOLUTIONS

1) The 2nd & 3rd and 4th & 5th numbers each add to 9999, or 20,000 - 2. Added to 2022, you get **22020**.

2) $\sqrt{5 \cdot 5 \cdot 5 \cdot 5 \cdot 3 \cdot 3} = 5 \cdot 5 \cdot 3 =$ **75**

3) $11 \cdot 12 - 132$ and $8 \cdot 2 = 16$ → **13216**

4) $111_3 = 9 + 3 + 1 = 13_{10} =$ **14_9**

5) $4^{2x+3} = 4^{6x-2}$, set the exponents equal to each other.

$2x + 3 = 6x - 2 \rightarrow 4x = 5 \rightarrow x =$ **$\frac{5}{4}$**

6) $\log_2 5x = \log_2(x + 20) \rightarrow 5x = x + 20 \rightarrow 4x = 20 \rightarrow x =$ **5**

7) $\frac{7}{99} \cdot \frac{1}{3} =$ **$\frac{7}{297}$**

8) A hexecontagon has 60 sides. $\frac{360}{60} =$ **6**

9) SA - $3\pi r^2 = 3\pi(10)^2 =$ **300π**

10) $36 \div (2)(3) + 4 = (18)(3) + 4 = 54 + 4 =$ **58**

11) **67**

12) This is the difference of cubes. 5 - 8 = **-3**

13) $100 - 16(5) = 100 - 80 =$ **20**

14) 9 evenly divides the first 11 digits. So, the remainder is **5**.

15) The watermelon had one pound of "meat" originally and after evaporation. x = new weight of the watermelon. $0.02x = 1 \rightarrow x =$ **50**.

16) alphabetically.

17) $\sqrt{(7-14)2+(11+13)2} = \sqrt{49+576} = \sqrt{625} =$ **25**

18) 2 & 5 are obvious. The sum of the digits is 58 → not 3. For 11, take the alternating sum of the digits which is 0. So, 11 also works. **2, 5, 11**

19) $12^3 + 18^3 = (12 + 18)(144 - 216 + 324) = (30)(252) =$ **7560**

20) We need multiples of 7 that fit the other descriptions → **91**

21) 70% of 700 = 490. $\frac{x}{5} = 490 \rightarrow x = 5 \cdot 490 =$ **2450**

22) a + b = 45, b + c = 56, a + c = 77 → By elimination a = 33, b = 12, and c = 44. 33 + 12 + 44 = **89**

23) $V = \frac{1}{3}\pi r^2 h$. Divide each volume by 5. C1 : $16\pi/3$ → r = 4. C2 : 3π → r = 3 (other 3's cancel).
Ratio is **4 : 3** or **$\frac{4}{3}$**

24) $a_n = a_1 \cdot r^{n-1} \rightarrow a_7 = 72 \cdot (\frac{1}{3})^{7-1} = 72 \cdot \frac{1}{729} =$ $\frac{72}{729} =$ **$\frac{8}{81}$**

25) This is a convergent geometric series. $S = \frac{a_1}{1-r}$ -->

$S = \frac{2}{1-0.5} =$ **4**

26) determinant = 20 - 20 = 0. **Singular** matrix.

27) 200 + 200 + 200 - 40 - 60 - 50 + 10 = **460**

28) 11-60-61 is a Pythagorean Triple → **122** inches

29) **circle** (see $5x^2 + 5y^2$)

30) **3,628,800**

31) First two terms are reciprocals → =1.
$\log_4 625 = \log_2 25 = 2\log_2 5$. $\frac{2\log_2 5}{\log_2 5} =$ **2**

32) 80 - 54 = 26 which is the age difference. So, mom was 39 when Nancy was 13. 80 - 39 = **41** years ago.

33) 1 mile = 5280 feet, 10 miles = 52800 feet, so 5 miles = **26,400** feet.

34) $\frac{(1000)(1001)}{2} = (500)(101) =$ **500,500**

35) $\frac{12+8+6+4+2+1}{24} = \frac{33}{24} =$ **$\frac{11}{8}$**

36) $\frac{18}{5} \cdot \frac{55}{18} = \frac{55}{5} =$ **11**

37) $\frac{10!}{(10-5)!} = \frac{10!}{5!} = 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 =$ **30,240**

38) $(80 + 78)(80 - 78) = (158)(2) =$ **316**

39) **December 31**

40) **1**