

The Roman Numeral System (p.62)

"Additive" system (vs. "positional" ...)

$$I=1^*, V=5, X=10^*, L=50, C=100^* \\ D=500, M=1000$$

(with "̄" = 1000·?)

* only one's used for subtraction

What is?

$$\textcircled{1} \quad \begin{array}{cccccc} C & L & X & X & V & I \\ \uparrow & \uparrow & \uparrow & \uparrow & \uparrow & \uparrow \\ 100 & 50 & 10 & 10 & 5 & 1 \end{array} = 100 + 50 + 10 + 10 + 5 + 1 \\ = \underline{176}$$

$$\textcircled{2} \quad \begin{array}{cccc} M & C & M & L & I & V \\ \uparrow & \underbrace{1000-100} & \uparrow & \underbrace{5-1} & & \\ 1000 & =900 & 50 & =4 & & \end{array} = 1000 + 900 + 50 + 4 \\ = \underline{1954}$$

③ Express the following in Roman Numerals

a) $2020 = 1000 + 1000 + 10 + 10$
 $= \boxed{MMXX}$

b) The year you born... eg. 1999

$$1999 = 1000 + 500 + 100 + 100 + 100 + 100 + 50 + 10 + 10 + 10 + 10 + 9 \\ = MDCCCLXXXIX$$

Better: $\boxed{MCMXCIX}$
(Best)

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c) 1,000,008

Since 1,000,000 = 1000 * 1000 = M̄
M̄ + 8 = M̄VIIII

d) 2,500,083

= 2,500,000 + 83
= 1000 * 2,500 + 50 + 10 + 10 + 10 + 1 + 1 + 1
MMD LXXXIIII

MMDLXXXIIII

4 Convert from Roman Numerals

a) DLXMMCDXXXIX
↑ 1000 ↑ 1000 ↑ 10 ↑ 10 ↑ 10-1
1000 * (500 + 50 + 10) 500 - 100

= 1000 * 560 + 1000 + 1000 + 400 + 10 + 10 + 9
= 560,000 + 2429 = 562,429

b) IXCMXLIV = 1000 * 9 + 900 + 40 + 4
↑ 1000-100 ↑ 50-10 ↑ 5-1
1000 * (10-1) 50-10 = 9944

Basic Properties of Arithmetic (Ch. 3)

Commutative Property:

Addition: $x + y = y + x$

Multiplication: $x \cdot y = y \cdot x$

e.g. $2 + 3 = 3 + 2$ & $2 \cdot 3 = 3 \cdot 2$

Associative Property:

Addition: $(x + y) + z = x + (y + z)$

Multiplication: $(x \cdot y) \cdot z = x \cdot (y \cdot z)$

e.g. $2 + 3 + 4$

$= (2 + 3) + 4$ OR $= 2 + (3 + 4)$

$= 5 + 4$ $= 2 + 7$

$= 9$

$= 9$

and

$2 \cdot 3 \cdot 4$

$= (2 \cdot 3) \cdot 4$

$= 6 \cdot 4$

$= 24$

OR

$= 2 \cdot (3 \cdot 4)$

$= 2 \cdot 12$

$= 24$

Distributive:

$x \cdot (y + z) = x \cdot y + x \cdot z$

e.g. $3 \cdot (2x - 6)$

$= 6x - 18$