

# Math 303

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#5.

$$\begin{array}{r} 150 \\ 54 \\ +260 \\ \hline 464 \end{array}$$

$$\begin{array}{r} 22 \\ 60 \\ 15 \\ +58 \\ +185 \\ \hline 340 \end{array}$$

$$\begin{array}{r} 464 \\ -340 \\ \hline 124 \end{array}$$

Wally has \$124 left to spend.

#7. (a)

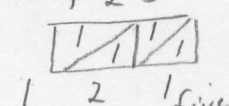
$$\begin{array}{r} 93 \\ -37 \\ \hline 56 \end{array}$$

(b)

$$\begin{array}{r} 321 \\ -38 \\ \hline 283 \end{array}$$

- #9. (a) Each column is added and recorded as added with no exchanges.  
 (b)  $8+5=13$ . The 3 is put in the tens column and the 1 in the units.  
 (c) The largest is subtracted from the smallest in each place-value position. Student is following the "bad rule" of "subtract the smallest from the largest."  
 (d) One ten was not exchanged for ten ones.

#13. (a)

$$\begin{array}{r} 43 \\ +23 \\ \hline \end{array}$$


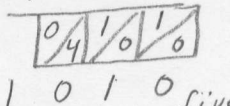
1 2 five

(b)

$$\begin{array}{r} 43 \\ -23 \\ \hline 20 \end{array}$$

two five

(c)

$$\begin{array}{r} 432 \\ +23 \\ \hline \end{array}$$


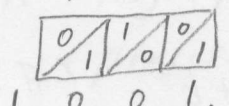
1 0 1 five

(d)

$$\begin{array}{r} 312 \\ 42 \\ -23 \\ \hline 14 \end{array}$$

four five

(e)

$$\begin{array}{r} 110 \\ +11 \\ \hline \end{array}$$


1 0 0 two

(f)

$$\begin{array}{r} 1010 \\ -111 \\ \hline 1010 \end{array}$$

two

#15. (a)

$$\begin{array}{r} 3 \text{ hr. } 36 \text{ min. } 58 \text{ sec.} \\ + 5 \text{ hr. } 56 \text{ min. } 27 \text{ sec.} \\ \hline 8 \text{ hr. } 92 \text{ min. } 85 \text{ sec.} \\ \hline 93 \text{ min.} \\ \hline 9 \text{ hr. } 33 \text{ min. } 25 \text{ sec.} \end{array}$$

(b)

$$\begin{array}{r} 4 \text{ hr. } 35 \text{ min. } 98 \text{ sec.} \\ - 3 \text{ hr. } 56 \text{ min. } 58 \text{ sec.} \\ \hline 1 \text{ hr. } 39 \text{ min. } 40 \text{ sec.} \end{array}$$

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$$\begin{array}{r} \phantom{0}3 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ \#18. (a) \phantom{0}4 \text{ gross} \phantom{0}4 \text{ doz.} \phantom{0}6 \text{ ones} \\ - \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ \phantom{0}3 \text{ gross} \phantom{0}10 \text{ doz.} \phantom{0}9 \text{ ones} \end{array}$$

$$\begin{array}{r} (b) \phantom{0}2 \text{ gross} \phantom{0}9 \text{ doz.} \phantom{0}7 \text{ ones} \\ + \phantom{0}3 \text{ gross} \phantom{0}5 \text{ doz.} \phantom{0}9 \text{ ones} \\ \hline \phantom{0}5 \text{ gross} \phantom{0}14 \text{ doz.} \phantom{0}16 \text{ ones} \\ \phantom{0}6 \text{ gross} \phantom{0}15 \text{ doz.} \\ \hline \phantom{0}6 \text{ gross} \phantom{0}3 \text{ doz.} \phantom{0}4 \text{ ones} \end{array}$$

$$\begin{array}{r} \phantom{0}2 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ \#20. (a) \phantom{0}2 \phantom{0}3 \phantom{0}0 \text{ five} \\ - \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ \phantom{0}2 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \end{array}$$

$$\begin{array}{r} \phantom{0}1 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ (b) \phantom{0}2 \phantom{0}0 \phantom{0}0 \phantom{0}1 \phantom{0}0 \text{ three} \\ - \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ \phantom{0}1 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \end{array}$$

$$\begin{array}{r} \phantom{0}3 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ \#21. (a) \phantom{0}3 \phantom{0}4 \phantom{0}2 \phantom{0}3 \text{ five} \\ - \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ \phantom{0}1 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \end{array}$$

$$\begin{array}{r} \phantom{0}1 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ (b) \phantom{0}1 \phantom{0}1 \phantom{0}0 \phantom{0}1 \phantom{0}1 \text{ two} \\ - \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ \phantom{0}1 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \end{array}$$

$$\begin{array}{r} \phantom{0}T \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ (c) \phantom{0}T \phantom{0}E \phantom{0}E \text{ twelve} \\ - \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ \phantom{0}T \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \end{array}$$

$$\begin{array}{r} \phantom{0}1 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ (d) \phantom{0}1 \phantom{0}0 \phantom{0}0 \phantom{0}0 \phantom{0}0 \text{ five} \\ - \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \\ \phantom{0}4 \phantom{00} \phantom{00} \phantom{00} \phantom{00} \phantom{00} \end{array}$$

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#6. Nice method. Cathy is using integer arithmetic.

#7. Regroup, trade, or exchange describe the actual process that is taking place; whereas, borrow implies the value will be returned and carry implies a change in value.

# Subtraction Worksheet

1. (a)

$$\begin{array}{r} 39 \\ -19 \\ \hline 1 \end{array} \quad \begin{array}{l} (20) \\ 10 \end{array} \quad \begin{array}{l} (30) \\ + 9 \end{array} \quad \begin{array}{l} (31-39) \\ \hline 20 \end{array}$$

$$\begin{array}{r} 39 \\ -19 \\ \hline 20 \end{array}$$

$$\begin{array}{r} 39 \\ -19 \\ \hline 20 \end{array}$$

$$\begin{array}{r} 39 \\ -19 \\ \hline 39 \\ +80 \\ \hline +19 \\ +1 \\ \hline 20 \end{array}$$

(b)

$$\begin{array}{r} 284 \\ -96 \\ \hline 4 \end{array} \quad \begin{array}{l} (97-100) \\ 80 \end{array} \quad \begin{array}{l} (110-180) \\ 100 \end{array} \quad \begin{array}{l} (280) \\ + 4 \end{array} \quad \begin{array}{l} (281-284) \\ \hline 188 \end{array}$$

$$\begin{array}{r} 1814 \\ 284 \\ -96 \\ \hline 110 \\ \hline 188 \end{array}$$

$$\begin{array}{r} 11714 \\ 284 \\ -96 \\ \hline 188 \end{array}$$

$$\begin{array}{r} 284 \\ -96 \\ \hline 284 \\ +903 \\ \hline +187 \\ +1 \\ \hline 188 \end{array}$$

(c)

$$\begin{array}{r} 6051 \\ -2503 \\ \hline 7 \end{array} \quad \begin{array}{l} (2504-2510) \\ 90 \end{array} \quad \begin{array}{l} (2520-2600) \\ 400 \end{array} \quad \begin{array}{l} (2700-3000) \\ 3000 \end{array} \quad \begin{array}{l} (4000-6000) \\ + 51 \end{array} \quad \begin{array}{l} (6001-6051) \\ \hline 3548 \end{array}$$

$$\begin{array}{r} 10 \quad '' \\ 6051 \\ -2503 \\ \hline 3 \quad 1 \\ \hline 3548 \end{array}$$

$$\begin{array}{r} 5 \quad 10 \quad 4 \quad '' \\ 6051 \\ -2503 \\ \hline 3548 \end{array}$$

$$\begin{array}{r} 6051 \\ -2503 \\ \hline 6051 \\ +7496 \\ \hline +3547 \\ +1 \\ \hline 3548 \end{array}$$

(d)

$$\begin{array}{r} 5374 \\ -2746 \\ \hline 4 \end{array} \quad \begin{array}{l} (2747-2750) \\ 50 \end{array} \quad \begin{array}{l} (2760-2800) \\ 200 \end{array} \quad \begin{array}{l} (2900-3000) \\ 2000 \end{array} \quad \begin{array}{l} (4000-5000) \\ + 374 \end{array} \quad \begin{array}{l} (5001-5374) \\ \hline 2628 \end{array}$$

$$\begin{array}{r} 13 \quad 14 \\ 5374 \\ -2746 \\ \hline 3 \quad 5 \\ \hline 2628 \end{array}$$

$$\begin{array}{r} 4 \quad 13 \quad 6 \quad 14 \\ 5374 \\ -2746 \\ \hline 2628 \end{array}$$

$$\begin{array}{r} 5374 \\ -2746 \\ \hline 5374 \\ +7253 \\ \hline +2627 \\ +1 \\ \hline 2628 \end{array}$$

#2. base 3

(a) base three

$$\begin{array}{r}
 2201 \\
 -1112 \\
 \hline
 1 \quad (1120) \\
 10 \quad (1200) \\
 100 \quad (2000) \\
 +201 \quad (2001-2201) \\
 \hline
 1012_{\text{three}}
 \end{array}$$

$$\begin{array}{r}
 \phantom{2} \phantom{2} \phantom{0} \phantom{1} \\
 \phantom{2} \phantom{2} \cancel{0} \cancel{1} \\
 -1 \cancel{1} \cancel{1} 2 \\
 \hline
 2 \phantom{2} \\
 1012_{\text{three}}
 \end{array}$$

$$\begin{array}{r}
 \phantom{2} \phantom{2} \phantom{0} \phantom{1} \\
 \phantom{2} \phantom{2} \cancel{0} \cancel{1} \\
 -1 \cancel{1} \cancel{1} 2 \\
 \hline
 1012_{\text{three}}
 \end{array}$$

$$\begin{array}{r}
 2201 \\
 -1112 \\
 \hline
 2201 \\
 +1110 \\
 \hline
 \cancel{1}1011 \\
 +1 \\
 \hline
 1012_{\text{three}}
 \end{array}$$

(b) base four

$$\begin{array}{r}
 3201 \\
 -1123 \\
 \hline
 1 \quad (1130) \\
 10 \quad (1200) \\
 200 \quad (1300, 2000) \\
 1000 \quad (3000) \\
 +201 \quad (3001-3201) \\
 \hline
 2012_{\text{four}}
 \end{array}$$

$$\begin{array}{r}
 \phantom{3} \phantom{2} \phantom{0} \phantom{1} \\
 \phantom{3} \phantom{2} \cancel{0} \cancel{1} \\
 -1 \cancel{1} \cancel{2} 3 \\
 \hline
 2 \phantom{3} \\
 2012_{\text{four}}
 \end{array}$$

$$\begin{array}{r}
 \phantom{3} \phantom{2} \phantom{0} \phantom{1} \\
 \phantom{3} \phantom{2} \cancel{0} \cancel{1} \\
 -1 \cancel{1} \cancel{2} 3 \\
 \hline
 2012_{\text{four}}
 \end{array}$$

$$\begin{array}{r}
 3201 \\
 -1123 \\
 \hline
 3201 \\
 +2210 \\
 \hline
 \cancel{1}2011 \\
 +1 \\
 \hline
 2012_{\text{four}}
 \end{array}$$

(c) base five

$$\begin{array}{r}
 4403 \\
 -2423 \\
 \hline
 \phantom{1} 2 \quad (2424, 2430) \\
 \phantom{1} 20 \quad (2440, 3000) \\
 1000 \quad (4000) \\
 +403 \quad (4001-4403) \\
 \hline
 1430_{\text{five}}
 \end{array}$$

$$\begin{array}{r}
 \phantom{4} \phantom{4} \phantom{0} \phantom{3} \\
 \phantom{4} \phantom{4} \cancel{0} \cancel{3} \\
 -2 \cancel{4} \cancel{2} 3 \\
 \hline
 3 \phantom{4} \\
 1430_{\text{five}}
 \end{array}$$

$$\begin{array}{r}
 \phantom{4} \phantom{4} \phantom{0} \phantom{3} \\
 \phantom{4} \phantom{4} \cancel{0} \cancel{3} \\
 -2 \cancel{4} \cancel{2} 3 \\
 \hline
 1430_{\text{five}}
 \end{array}$$

$$\begin{array}{r}
 4403 \\
 -2423 \\
 \hline
 4403 \\
 +2021 \\
 \hline
 \cancel{1}424 \\
 +1 \\
 \hline
 1430_{\text{five}}
 \end{array}$$

(d) base six

$$\begin{array}{r}
 3524 \\
 -1453 \\
 \hline
 3 \quad (1454, 1455, 1500) \\
 100 \quad (2000) \\
 1000 \quad (3000) \\
 +524 \quad (3001-3524) \\
 \hline
 2031_{\text{six}}
 \end{array}$$

$$\begin{array}{r}
 35\overset{12}{2}4 \\
 -1\overset{4}{4}53 \\
 \hline
 5 \\
 2031_{\text{six}}
 \end{array}$$

$$\begin{array}{r}
 3\overset{4}{4}\overset{12}{7}4 \\
 -1453 \\
 \hline
 2031_{\text{six}}
 \end{array}$$

$$\begin{array}{r}
 3524 \\
 -1453 \\
 \hline
 3524 \\
 +4102 \\
 \hline
 2030 \\
 +1 \\
 \hline
 2031_{\text{six}}
 \end{array}$$

#3. (a)  $32$   
 $-24$   
 $\hline$   
 $6$   
 $25, 26, 27,$   
 $30, 31, 32$   
 base eight

(b)  $\overset{2}{3}\overset{12}{3}\overset{10}{4}\overset{11}{1}$   
 $-1323$   
 $\hline$   
 $1433$   
 base five

(c)  $\overset{12}{3}\overset{11}{4}\overset{11}{1}$   
 $-2223$   
 $\hline$   
 $333$   
 $766$   
 base eight

(d)  $\overset{3}{4}\overset{10}{4}\overset{12}{3}\overset{11}{1}$   
 $-2233$   
 $\hline$   
 $1454$   
 base six

(e)  $4\overset{10}{4}\overset{11}{6}\overset{11}{1}$   
 $-2455$   
 $\hline$   
 $36$   
 $1707$   
 base eleven

#4. (a) Taylor is always subtracting the least value from the greatest value in each place-value position.

The teacher may have made a statement such as:  
 "Always subtract the smaller from the larger."

(b) Margarita's algorithm is a correct method. She is recording her exchanges in the fourth line and subtracting the exchanges in a second step.

(c) Scott is not doing the second exchange when the minuend contains one or more zeros. See part (c).

(d) Sally's error is similar to Scott's, except Sally is doing a double exchange when there is a zero in the minuend.