

What to bring to class:
Ask students to bring PM
4A and 5A.

3.5-Estimation - transition to multi-digit long division

Division with 1-digit divisions (stage 1) is easy because we know 1 through 10x10 mult. facts.

Ex:
$$\begin{array}{r} 62 \\ 6 \overline{)372} \\ \underline{36} \\ 12 \\ \underline{12} \\ 0 \end{array}$$
 (give students 30 sec.)

ask: What did you have to know? $6 \times 6, 6 \times 2$

If we knew mult table for 16, then long division by 16 would be easy:

use
mental
math
to fill
out

- 16 x 1 = 16
- 16 x 2 = 32
- 16 x 3 = 48
- 16 x 4 = 64
- 16 x 5 = 80
- 16 x 6 = 96
- 16 x 7 = 112
- 16 x 8 = 128
- 16 x 9 = 144

$$\begin{array}{r} 572 \\ 16 \overline{)9152} \\ \underline{80} \\ 115 \\ \underline{112} \\ 32 \end{array}$$

Ex: find $16,500,188 \div 29$ (groups of 2, 2 min)

start
& pt
out

- 29 x 1 = 29
- 29 x 2 = 58
- 29 x 3 = 87
- 29 x 4 = 4 x 30 - 4 = 116
- x 5 = 145
- x 6 = 174
- x 7 = 203
- x 8 = 232
- x 9 = 261

$$\begin{array}{r} 568972 \\ 29 \overline{)16500188} \\ \underline{145} \\ 200 \\ \underline{174} \\ 260 \\ \underline{232} \\ 281 \\ \underline{261} \\ 208 \\ \underline{203} \\ 58 \\ \underline{58} \\ 0 \end{array}$$

When we don't have such tables we can estimate instead.

Def: Estimation is the process of finding an approximate answer (the "estimate") to a given computation.

Used:

*when only approx answers are required.

"Roughly how many hours in 400 min of cellphone time?"

$$400 \div 60 \approx 420 \div 60 = 7 \text{ hrs}$$

*to check answers to complex calc's

$$\begin{array}{r} 123.234 \times 1.8873 \approx 120 \times 2 \approx 80 \\ 3.256 \qquad \qquad \qquad 3 \end{array}$$

Say: can also estimate measurements (how much does this child weigh?) but we won't discuss that.

Estimation uses: Mental Math, Place Value, Round-off

Round up 5's algorithm: (easily taught using number line)

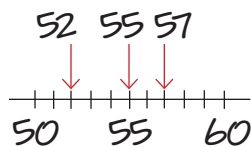
Ex: Round to nearest 10

$$52 \rightsquigarrow 50$$

$$57 \rightsquigarrow 60$$

$$55 \rightsquigarrow 60$$

(round mid pt up by convention)



Ex: Round 2735 to nearest 10 \rightsquigarrow 2740

100 \rightsquigarrow 2700

1000 \rightsquigarrow 3000

Look at PM 4A pg 13 & 15

* It's an algorithm

* quickly developed, pg 13 - # line, pg 14 Arithmetic exer, pg 15, Early word prob.

Estimation Techniques

1. Round to Compatible #'s

$$* 405 \times 243 \approx 400 \times 25 = 4 \times 100 \times 25 = 100 \times 100 = 10,000$$

$$* 4778 \div 62 \approx 4800 \div 60 = 80$$

2. Front end - truncate after 1st or 2nd largest denominations

$$* 476 + 531 \approx 47 \text{ tens} + 53 \text{ tens} = 100 \text{ tens}$$

$$* 356 + 622 \approx 3 \text{ hundreds} + 6 \text{ hundreds} = 900$$

3. Front end with Adjustments

$$* 498 + 251 \xrightarrow{\text{front end}} 400 + 200 = 600$$

$$\xrightarrow{\text{adjust}} 600 + (100 + 50) = 750 \\ \approx 98 + 51$$

4. High - Low Range estimate: Get upper/lower estimate by consistently rounding up or down

* Addition $587 + 734$

500	583	600
<u>+700</u>	<u>+734</u>	<u>+800</u>
1200	< actual <	1400
low		high

* Multiplication 386×892

300	386	400
<u>x800</u>	<u>x892</u>	<u>x900</u>
240000	< actual <	360000
low		high

Simple Estimation - Rounding to 1-digit arithmetic problems

(ex: $78 - 6$, 7×8 , $36 - 9$)

Have students open PM 5A Workbook.

* Do Pg 11 in Workbooks (2-minutes)

say: these are "1-digit" arithmetic problems.

Goal is to reduce complicated problems to ones like these.

* Pg 12 do a, b, e, f, Notice rounding & 1-digit.

* Pg 13 do a, b, e, f, " " " "

Then combine with PV:

* Pg 14 do 1a, b PV
c (not 1-digit so harder)

* Pg 15

- 2a (on board)

$$326 \times 47 \approx 300 \times 50 = 15 \times 10 \times 10 \times 10 = 15000$$



rounding

"same number of zeros"

- do 2bc

- do 3

Instructor puts on board:

$$28 \times 229 \times 30 \times 200 = \$600$$



round up
round down

(compensation!!)

optional: Always an issue of how accurate to be:

$$16.1 \times 27.3 \approx \begin{cases} 16 \times 27 \\ 15 \times 30 \\ 10 \times 30 \end{cases}$$

which to pick? question
for students & teachers.

Teachers/books should be clear about

* expected accuracy

* method

* use numbers with "obvious" estimate

If time: PM 5A WB Pg 16-17
call on students to answer
1a, 1b, 1c, 1d

Do 2a verbally (say: reduce to previous type of problem)
Have students do 2b, 3

↑ put on board.

$$805 \div 28 \approx 800 \div 30$$

↑ round ↑ round
down up

(compensation !!)

HW - Read 3.5

Do HW #14