

Math 190
Fall 2019
Dr. Lily Yen

Quiz 3

Show all your work

Family name: _____
Given name: _____
Student number: _____
Score: ____/22

No calculator on this quiz.

Problem 1: If 4567 is tripled, find the ones digit (unit digit) of the result.

The ones digit of a product equals the (ones digit of the) product of the ones digits. Here $3 \times 7 = 21$, so the ones digit of 3×4567 is 1. Indeed, $3 \times 4567 = 13\,701$.

Score: /1

Problem 2: Find $6 \times 10\,000 + 5 \times 1000 + 4 \times 10 + 3 \times 1$.

65043

Score: /1

Problem 3: Write 20_{ten} in base 20. Include the base in your answer.

$20 = 1 \times 20 + 0$, so 10_{twenty} .

Score: /1

Problem 4: Write $b^3 + b^2$ in base b . Include the base in your answer.

1100_b .

Score: /2

Problem 5: How do you know that there is an error in the statement $13\frac{3}{4} = 25.3_{\text{four}}$?

Base four does not have a digit 5. The correct statement would be $13\frac{3}{4} = 31.3_{\text{four}}$.

Score: /1

Problem 6: Without converting to base ten, compare these pairs of numbers by placing $<$,

$>$, or $=$ in each box. i) 100_{five} $\boxed{>}$ 18_{nine} ; ii) 111_{two} $\boxed{=}$ 7_{ten} , and iii) 23_{six} $\boxed{>}$ 23_{five} .

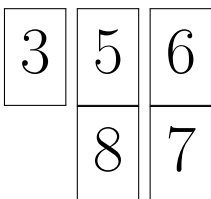
$100_{\text{five}} = 25_{\text{ten}}$ where as $18_{\text{nine}} = 17_{\text{ten}}$

$23_{\text{six}} = 15$ $\boxed{>}$ $23_{\text{five}} = 13$

Score: /3

$\boxed{/9}$

Problem 7: Each of the digits 3, 5, 6, 7, and 8 is placed one to a box in the diagram. If the two digit number is subtracted from the three digit number, what is the smallest possible difference?



The difference is smallest when the three digit number is as small as possible, namely 356,

and the two digit number is as large as possible, namely 87. Fortunately, these can happen simultaneously to get a difference of 269.

Score: /3

Problem 8: Determine the base used for each arithmetic. Check your arithmetic in the base you claim to justify your answer.

a. $31 + 24 = 110$

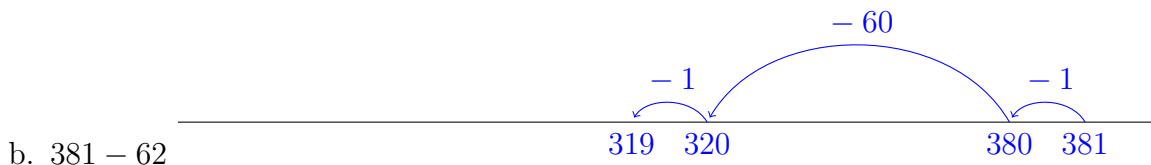
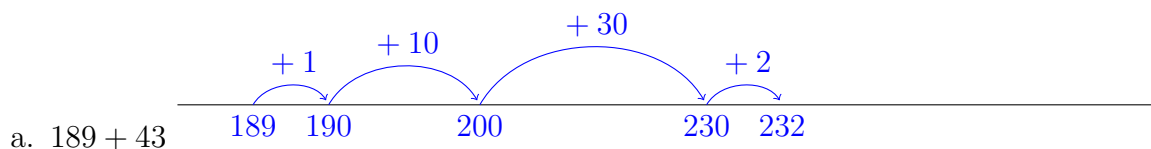
If the base is b , then $(3b + 1) + (2b + 4) = b^2 + b$, so $5b + 5 = b^2 + b$, so $4b + 5 = b^2$. Since $b > 4$, guess-and-check quickly yields $b = 5$.

b. $3211 - 2222 = 767$

If the base is b , then $(3b^3 + 2b^2 + b + 1) - (2b^3 + 2b^2 + 2b + 2) = 7b^2 + 6b + 7$, so $b^3 - b - 1 = 7b^2 + 6b + 7$, so $b^3 = 7b^2 + 7b + 8$. Since $b > 7$, guess-and-check quickly yields $b = 8$.

Score: /6

Problem 9: Perform each of the following on the number line in at least two smaller jumps to demonstrate easier mental calculation.



Score: /4