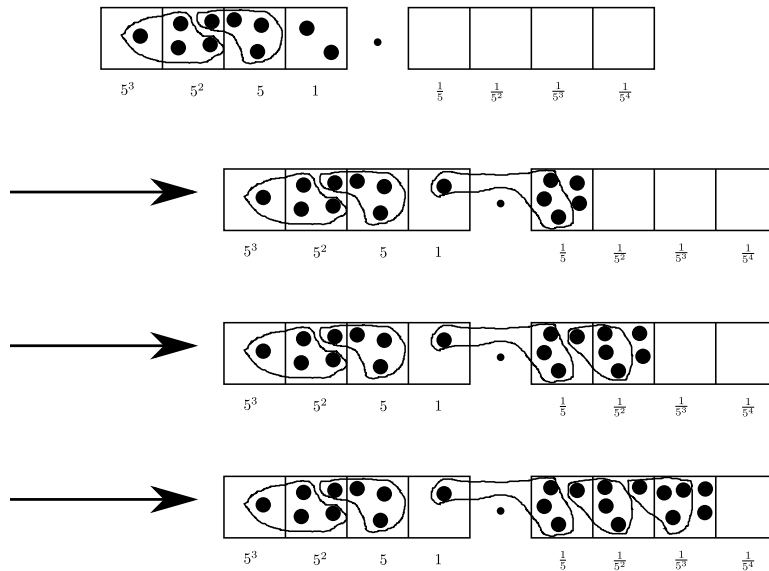


# Exploding Dots and Decimals

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Here is  $1432 \div 13$ , in base 5, using “unexploding dots” (to get decimals):



Thus, you can see  $1432 \div 13 = 110.1111 \dots$

Do the following using decimals and exploding dot machines. Use a  $1 \leftarrow 10$  machine if it does not explicitly say what to use.

1. Compute  $3 \div 8$ .
2. Compute  $\frac{3}{16}$ .
3. Compute  $8 \div 3$ .
4. Compute  $1024 \div 3$ .
5. Compute  $6 \div 7$ . (Be sure to note where the repeat happens and why.)
6. Compute  $1 \div 11$ .
7. Compute  $255 \div 11$ .

# Addition and Subtraction

8. Compute the following using dots and boxes and using the “traditional approach.”

(a)  $0.35 + 0.89$

(b)  $4.223 + 9.0971$

(c)  $78.9999 + 87.99$

(d)  $0.1 + 0.003 + 0.00007$

9. Analyze:

(a) Agatha says that computing  $0.0348 + 0.0057$  is essentially a matter of adding 348 and 57. What does she mean by this? Is she right?

(b) Percy says that adding  $0.0852 + 0.037$  is essentially a matter of adding 852 and 37. Is he right? Why or why not?

10. Compute the following using dots and boxes and using the “traditional approach.”

(a)  $0.87 - 0.61$

(b)  $0.672 - 0.035$

(c)  $0.506 - 0.27$

(d)  $12.987 - 3.8906$

(e)  $0.45 - 0.6003$

(f)  $2.22 - 1.111$

(g)  $5 - 0.187$

# Multiplication

11. Compute the following.

(a)  $0.07 \times 0.4$

(b)  $0.005 \times 0.01$

(c)  $0.002 \times 0.005$

(d)  $6 \times 0.05$

(e)  $0.00037 \times 0.4$

(f)  $10 \times 0.4$

(g)  $10 \times 0.069$

(h)  $100 \times 0.0987$

(i)  $1000 \times 0.41$

12. Nervous Nelly half remembers some rule about “shifting the decimal point” left or right when multiplying a decimal by 10 or by 100 or by 1000. What rule might Nelly be trying to recall? Is it worth memorizing such a rule? Does the decimal point really shift?

## Division

13. Compute

- (a)  $0.009 \div 0.03$
- (b)  $0.02 \div 0.5$
- (c)  $0.02 \div 5$
- (d)  $0.02 \div 50$
- (e)  $8.1 \div 0.09$
- (f)  $500 \div 0.001$
- (g)  $0.004 \div 0.008$

14. Compute

- (a)  $0.abc \div 10$
- (b)  $0.abc \div 100$
- (c)  $0.abc \div 0.1$
- (d)  $0.abc \div 0.01$
- (e)  $0.abc \times 100$
- (f)  $0.abc \times 0.001$

15. Compute

- (a)  $0.3 \times (5.37 - 2.07) + \frac{0.75}{2.5}$
- (b)  $\frac{0.01 + (1.01 - 0.1)}{0.11 + 0.09}$
- (c)  $\frac{(0.002 + 0.2 \times 2.02)(2.2 - 0.22)}{2.22 - 0.22}$

## Other Bases

16. Compute  $1 \div 11_3$  in a base 3 machine.

17. Find the base 4 representation of  $\frac{2}{5}$ .

18. What fraction has expansion  $0.32323232\dots$  in base 7? Write your answer in two ways: as a fraction base 7 and as a fraction in base 10.

19. What fraction has expansion  $0.131313\dots$  in base 9? Write your answer in two ways: as a fraction base 9 and as a fraction in base 10.