

●3-5 Fractions and Decimals

- What part of an hour elapses from 4:56 P.M. to 5:32 P.M.?
 - $\frac{1}{4}$
 - $\frac{1}{2}$
 - $\frac{3}{5}$
 - $\frac{2}{3}$
 - $\frac{3}{4}$
- If each of the fractions $\frac{3}{k}$, $\frac{4}{k}$, $\frac{5}{k}$ is in lowest terms, which of the following could be the value of k ?
 - 48
 - 49
 - 50
 - 51
 - 52
- Which number has the greatest value?
 - 0.2093
 - 0.2908
 - 0.2893
 - 0.2938
 - 0.2909
- The elapsed time from 11:00 A.M. to 3:00 P.M. on Wednesday of the same day is what fraction of the elapsed time from 11:00 A.M. on Wednesday to 3:00 P.M. on Friday of the same week?
 - $\frac{1}{15}$
 - $\frac{1}{14}$
 - $\frac{1}{13}$
 - $\frac{4}{51}$
 - $\frac{1}{12}$
- In which number is the digit 3 in the hundredths place?
 - 300.000
 - 30.000
 - 0.300
 - 0.030
 - 0.003
- In which arrangement are the fractions listed from least to greatest?
 - $\frac{9}{19}, \frac{1}{2}, \frac{8}{15}$
 - $\frac{1}{2}, \frac{8}{15}, \frac{9}{19}$
 - $\frac{9}{19}, \frac{8}{15}, \frac{1}{2}$
 - $\frac{1}{2}, \frac{9}{19}, \frac{8}{15}$
 - $\frac{8}{15}, \frac{1}{2}, \frac{9}{19}$

7. After the formula $V = \frac{4}{3}\pi r^3$ has been evaluated for some positive value of r , the formula is again evaluated using one-half of the original value of r . The new value of V is what fractional part of the original value of V ?
- (A) $\frac{1}{16}$
 (B) $\frac{1}{9}$
 (C) $\frac{1}{8}$
 (D) $\frac{1}{4}$
 (E) $\frac{1}{2}$
8. Each inch on ruler A is marked in equal $\frac{1}{8}$ -inch units, and each inch on ruler B is marked in equal $\frac{1}{12}$ -inch units. When ruler A is used, a side of a triangle measures 12 of the $\frac{1}{8}$ -inch units. When ruler B is used, how many $\frac{1}{12}$ -inch units will the same side measure?
- (A) 8
 (B) 12
 (C) 18
 (D) 20
 (E) 24
9. $60 + 2 + \frac{4}{8} + \frac{3}{500} =$
- (A) 60.256
 (B) 62.43
 (C) 62.506
 (D) 62.53
 (E) 62.560
10. If $N \times \frac{7}{12} = \frac{7}{12} \times \frac{3}{14}$, then $\frac{1}{N} =$
- (A) 8
 (B) $\frac{14}{3}$
 (C) $\frac{12}{7}$
 (D) $\frac{3}{14}$
 (E) $\frac{1}{6}$
11. If $n = 2.5 \times 10^{25}$, then $\sqrt{n} =$
- (A) 0.5×10^5
 (B) 0.5×10^{12}
 (C) $5 \times 10^{\sqrt{24}}$
 (D) 5×10^5
 (E) 5×10^{12}
12. If y is a real number and $y = \frac{x-2}{x+3}$, then x CANNOT equal which of the following numbers?
- (A) -3
 (B) -2
 (C) 0
 (D) 2
 (E) 3
13. If eight pencils cost \$0.42, how many pencils can be purchased with \$2.10?
- (A) 16
 (B) 24
 (C) 30
 (D) 36
 (E) 40
14. A store sells 8-ounce containers of orange juice at \$0.69 each and 12-ounce containers of orange juice at \$0.95 each. How much money will be saved by purchasing a total of 48 ounces of orange juice in 12-ounce rather than 8-ounce containers?
- (A) \$0.24
 (B) \$0.32
 (C) \$0.34
 (D) \$0.48
 (E) \$0.56

15. In the repeating decimal

$$0.\overline{31752} = 0.3175231752 \dots$$

the set of digits 31752 repeats endlessly.
Which digit is in the 968th place to the right of the decimal point?

- (A) 1
- (B) 2
- (C) 3
- (D) 5
- (E) 7

Grid-In

1. If $\frac{4\Delta}{6\Delta} + \frac{5}{17} = 1$, what digit does Δ represent?
2. On a certain map, 1.5 inches represents a distance of 45 miles. If two points on the map are 0.8 inch apart, how many miles apart are these two points?
3. Four lemons cost \$0.68. At the same rate, 1 pound of lemons costs \$1.19. How many lemons typically weigh 1 pound?
4. If the charge for a taxi ride is \$2.50 for the first $\frac{1}{2}$ mile and \$0.75 for each additional $\frac{1}{8}$ mile, how many miles did the taxi travel for a ride that cost \$10.75?
5. One cubic foot of a certain metal weighs 8 pounds and costs \$4.20 per pound. If 1 cubic foot is equivalent to 1,728 cubic inches, what is the cost of 288 cubic inches of the same metal?

●3-6 Operations with Fractions

1. John completes a race in $9\frac{1}{3}$ minutes, and Steve finishes the same race in $7\frac{3}{4}$ minutes. How many seconds after Steve finishes the race does John complete the race?
 - (A) 72
 - (B) 90
 - (C) 92
 - (D) 95
 - (E) 100
2. Multiplying a number by $\frac{1}{2}$ and then dividing the result by $\frac{3}{4}$ is equivalent to performing which of the following operations on the number?
 - (A) Multiplying by $\frac{2}{3}$
 - (B) Dividing by $\frac{2}{3}$
 - (C) Multiplying by $\frac{3}{8}$
 - (D) Dividing by $\frac{3}{8}$
 - (E) Multiplying by 3

3. A convenience store buys keychains wholesale for \$0.75 apiece and then sells them for \$1.25. Assuming no other costs, how many keychains must be sold in order to make a profit of \$250?

(A) 50
(B) 100
(C) 200
(D) 500
(E) 600

4. What is $\frac{3}{4}$ of $\frac{2}{3}$ of 12?

(A) 2
(B) 3
(C) 4
(D) 6
(E) 8

5. What is $\frac{2}{21}$ of $3 \times 5 \times 7$?

(A) 6
(B) 9
(C) 10
(D) 12
(E) 15

6. For which value of n is $\frac{1}{4} < n < \frac{1}{3}$?

(A) $\frac{5}{24}$
(B) $\frac{6}{24}$
(C) $\frac{7}{24}$
(D) $\frac{8}{24}$
(E) $\frac{9}{24}$

7. If $0 < x < 1$, then which of the following statements must be true?

I. $\frac{1}{x} - x < 0$

II. $x^2 + x^2 > x$

III. $\frac{x}{\sqrt{x}} > x^2$

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I and III only

8. If $k = \frac{c}{\frac{a}{b}}$, which expression equals $\frac{1}{k}$?

(A) $\frac{ac}{b}$

(B) $\frac{b}{ac}$

(C) $\frac{a}{bc}$

(D) $\frac{bc}{a}$

(E) $\frac{1}{abc}$

9. An item is on sale on Monday at $\frac{1}{3}$ off the list price of d dollars. On Friday, the sale price of the item is reduced by $\frac{1}{4}$ of the current price. What is the number of dollars in the final sale price of the item?

(A) $\frac{d}{2}$

(B) $\frac{d}{3}$

(C) $\frac{d}{4}$

(D) $\frac{d}{6}$

(E) $\frac{d}{8}$

10. If a and b are integers $\frac{a}{b} = \frac{2}{3}$ and $5 < b < 13$, how many possible values are there for a ?
- (A) One
(B) Two
(C) Three
(D) Four
(E) Five

11. If $\frac{a}{b}$ is a positive fraction less than 1, which of the following fractions MUST be greater than 1?

- (A) $\left(\frac{a}{b}\right)^2$
(B) $2\left(\frac{a}{b}\right)$
(C) $\frac{a}{2b}$
(D) $\frac{a+2}{b+2}$
(E) $\frac{2}{\frac{a}{b}}$

12. Juan gives $\frac{2}{3}$ of his p pencils to Roger and then gives $\frac{1}{4}$ of the pencils that he has left to Maria. In terms of p , how many pencils does Juan now have?

- (A) $\frac{1}{6}p$
(B) $\frac{1}{4}p$
(C) $\frac{1}{3}p$
(D) $\frac{1}{2}p$
(E) $\frac{5}{6}p$

13. The statement $a^3 < a^2 < a$ is true when

- I. $a > 1$
II. $0 < a < 1$
III. $-1 < a < 0$
- (A) I and III only
(B) II and III only
(C) II only
(D) III only
(E) None

Grid-In

1. If $y = \sqrt{\frac{x+4}{2}}$, what is the value of y when $x = \frac{1}{2}$?

2. What fraction of $\frac{10}{9}$ is $\frac{5}{6}$?

3. If $25\left(\frac{x}{y}\right) = 4$, what is the value of $100\left(\frac{y}{x}\right)$?

4. $P = \left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)\left(1 + \frac{1}{4}\right)\cdots\left(1 + \frac{1}{17}\right)$

If each factor in the above product has the form $\left(1 + \frac{1}{k}\right)$, where k represents all the consecutive integers from 2 to 17, what is the value of P ?

5. If $c = 1 + \frac{1}{2}d$ and $d = 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$, what is the value of $c - d$?

● 3-7 Fraction Word Problems

1. If $\frac{3}{8}$ of a number is 6, what is $\frac{7}{8}$ of the same number?
(A) 8
(B) 12
(C) 14
(D) 16
(E) 24
2. After Claire has read the first $\frac{5}{8}$ of a book, there are 120 pages left to read. How many pages of the book has Claire read?
(A) 160
(B) 200
(C) 240
(D) 300
(E) 320
3. $\frac{4}{9}$ of 27 is $\frac{6}{5}$ of what number?
(A) 5
(B) 10
(C) 12
(D) 15
(E) 20
4. If $\frac{3}{5}$ of a class that includes 10 girls are boys, how many students are in the class?
(A) 15
(B) 20
(C) 21
(D) 25
(E) 30
5. What is the sum of all two-digit whole numbers in which one digit is $\frac{3}{4}$ of the other digit?
(A) 77
(B) 102
(C) 129
(D) 154
(E) 231
6. Boris has D dollars. If he lends $\frac{1}{4}$ of this amount of money and then spends $\frac{1}{3}$ of the money that he has left, how many dollars, in terms of D , does Boris now have?
(A) $\frac{D}{2}$
(B) $\frac{D}{3}$
(C) $\frac{D}{4} - \frac{1}{3}$
(D) $\frac{3}{4}D - \frac{1}{3}$
(E) $\frac{11}{12}D$
7. The value obtained by increasing a by $\frac{1}{5}$ of its value is numerically equal to the value obtained by decreasing b by $\frac{1}{2}$ of its value. Which equation expresses this fact?
(A) $1.2a = 0.5b$
(B) $0.2a = 0.5b$
(C) $0.8a = 1.5b$
(D) $1.2a = 1.5b$
(E) $a + 0.2 = b - 0.5$
8. How many times must a jogger run around a circular $\frac{1}{4}$ -mile track in order to have run $3\frac{1}{2}$ miles?
(A) 9
(B) 12
(C) 14
(D) 15
(E) 16

9. A chocolate bar that weighs $\frac{9}{16}$ of a pound is cut into seven equal parts. How much do three parts weigh?
- (A) $\frac{21}{112}$ pound
(B) $\frac{27}{112}$ pound
(C) $\frac{16}{63}$ pound
(D) $\frac{47}{63}$ pound
(E) $\frac{85}{112}$ pound
10. At a high school basketball game, $\frac{3}{5}$ of the students who attended were seniors, $\frac{1}{3}$ of the other students who attended were juniors, and the remaining 80 students who attended were all sophomores. How many seniors attended this game?
- (A) 120
(B) 175
(C) 180
(D) 210
(E) 300
11. Of the 75 people in a room, $\frac{2}{5}$ are college graduates. If $\frac{4}{9}$ of the students who are not college graduates are seniors in high school, how many people in the room are neither college graduates nor high school seniors?
- (A) 15
(B) 20
(C) 25
(D) 36
(E) 40
12. If $\frac{2}{3}$ of $\frac{3}{4}$ of a number is 24, what is $\frac{1}{4}$ of the same number?
- (A) 8
(B) 12
(C) 16
(D) 20
(E) 24
13. A man paints $\frac{3}{4}$ of a house in 2 days. If he continues to work at the same rate, how much more time will he need to paint the rest of the house?
- (A) $\frac{1}{4}$ day
(B) $\frac{1}{2}$ day
(C) $\frac{2}{3}$ day
(D) 1 day
(E) $\frac{4}{3}$ days
14. A water tank is $\frac{3}{5}$ full. After 12 gallons are poured out, the tank is $\frac{1}{3}$ full. When the tank is full, how many gallons of water does it hold?
- (A) 25
(B) 32
(C) 35
(D) 42
(E) 45
15. In a school election, Susan received $\frac{2}{3}$ of the ballots cast, Mary received $\frac{1}{5}$ of the remaining ballots, and Bill received all of the other votes. If Bill received 48 votes, how many votes did Susan receive?
- (A) 75
(B) 90
(C) 120
(D) 150
(E) 180

16. After Arlene pumps gas into the gas tank of her car, the gas gauge moves from exactly $\frac{1}{8}$ full to exactly $\frac{7}{8}$ full. If the gas costs \$1.50 per gallon and Arlene is charged \$18.00 for the gas, what is the capacity, in gallons, of the gas tank?

(A) 24
(B) 20
(C) 18
(D) 16
(E) 15

17. At the beginning of the day, the prices of stocks A and B are the same. At the end of the day, the price of stock A has increased by $\frac{1}{10}$ of its original price and the price of stock B has decreased by $\frac{1}{10}$ of its original price. The new price of stock A is what fraction of the new price of stock B ?

(A) $\frac{2}{10}$
(B) $\frac{9}{11}$
(C) $\frac{9}{10}$
(D) $\frac{11}{10}$
(E) $\frac{11}{9}$

18. After $\frac{3}{4}$ of the people in a room leave, three people enter the same room. The number of people who are now in the room, assuming no other people enter or leave, is $\frac{1}{3}$ of the original number of people who were in the room. How many people left the room?

(A) 9
(B) 18
(C) 24
(D) 27
(E) 36

Grid-In

1. After a number is increased by $\frac{1}{3}$ of its value, the result is 24. What was the original number?
2. In an election, $\frac{1}{2}$ of the male voters and $\frac{2}{3}$ of the female voters cast their ballots for candidate A . If the number of female voters was $1\frac{1}{2}$ times the number of male voters, what fraction of the total number of votes cast did candidate A receive?

Lesson 3-5

MULTIPLE-CHOICE

1. (C) To find the number of minutes that elapse from 4:56 P.M. to 5:32 P.M., subtract 4 hours and 56 minutes from 5 hours and 32 minutes:

$$\begin{array}{r} 5 \text{ hours } 32 \text{ min} \\ - 4 \text{ hours } 56 \text{ min} \\ \hline \end{array} \Rightarrow \begin{array}{r} 4 \text{ hours } 92 \text{ min} \\ - 4 \text{ hours } 56 \text{ min} \\ \hline 36 \text{ min} \end{array}$$

Since

$$\frac{36 \text{ minutes}}{1 \text{ hour}} = \frac{36}{60} = \frac{12 \times 3}{12 \times 5} = \frac{3}{5}$$

the number of minutes that elapse from 4:56 P.M. to 5:32 P.M. is $\frac{3}{5}$ of an hour.

2. (B) If each of the fractions $\frac{3}{k}, \frac{4}{k}, \frac{5}{k}$ is in lowest terms, then k cannot be divisible by 3, 4, and 5. Of the answer choices, only 49 is not divisible by 3, 4, and 5.
3. (D) To find the number that has the greatest value, compare each digit, reading from left to right. The numbers in choices (A) and (C) can be eliminated since they are less than any of the other choices. Since the thousandths digit of 0.2938 is greater than the thousandths digit of each of the remaining answer choices, 0.2938 is the largest number.
4. (C) Four hours elapse from 11:00 A.M. to 3:00 P.M. on Wednesday of the same day, and $52 (= 24 + 24 + 4)$ hours elapse from 11:00 A.M. on Wednesday to 3:00 P.M. on Friday of the same week. To compare these elapsed times, form the fraction

$$\frac{4}{52} = \frac{1}{13} = \frac{1}{13}$$

5. (D) In 0.030, the digit 3 is located two places to the *right* of the decimal point, so it is in the hundredths place.
6. (A) Since $\frac{9.5}{19} = \frac{1}{2}$, then $\frac{9}{19} < \frac{1}{2}$. Similarly, $\frac{7.5}{15} = \frac{1}{2}$, so $\frac{8}{15} > \frac{1}{2}$. Hence, you can eliminate answer choices (B), (C), (D), and (E). Choice (A) is the correct answer.
7. (C) Since $\left(\frac{1}{2}\right)^3 = \frac{1}{8}$, the new value of V is $\frac{1}{8}$ of the original value of V .

8. (C) Since each inch on ruler A is marked in equal $\frac{1}{8}$ -inch units, a side that measures 12 of these $\frac{1}{8}$ -inch units is

$$12 \times \frac{1}{8} = \frac{3}{2} = 1\frac{1}{2} \text{ inches long}$$

If the same side is measured with ruler B , which is marked in equal $\frac{1}{12}$ -inch units, the side will measure 18 of these $\frac{1}{12}$ -inch units since

$$1\frac{1}{2} = \frac{12}{12} + \frac{6}{12}$$

and $12 + 6 = 18$.

9. (C) $60 + 2 + \frac{4}{8} + \frac{3}{500} = 62 + 0.5 + 0.006 = 62.506$.
10. (B) Since $N \times \frac{7}{12} = \frac{7}{12} \times \frac{3}{14}$, you can cancel $\frac{7}{12}$ on each side to get $N = \frac{3}{14}$, so $\frac{1}{N} = \frac{14}{3}$.
11. (E) If $n = 2.5 \times 10^{25}$, then
- $$\begin{aligned} \sqrt{n} &= \sqrt{2.5 \times 10^{25}} \\ &= \sqrt{25 \times 10^{24}} \\ &= \sqrt{25} \times \sqrt{10^{24}} \\ &= 5 \times \sqrt{10^{12} \cdot 10^{12}} \\ &= 5 \times 10^{12} \end{aligned}$$
12. (A) Since division by 0 is not allowed, a variable in the denominator of a fraction cannot be equal to a number that makes the denominator evaluate to 0. If $y = \frac{x-2}{x+3}$, then x cannot be equal to -3 since $-3 + 3 = 0$.

13. (E) Eight pencils cost \$0.42, and $\$2.10 \div 0.42 = 5$. Hence, $8 \times 5 = 40$ pencils can be purchased.

14. (C) For a total of 48 ounces of orange juice, six 8-ounce containers must be purchased since $6 \times 8 \text{ ounces} = 48 \text{ ounces}$. If each 8-ounce container costs \$0.69, six of these containers will cost $6 \times \$0.69 = \4.14 . For a total of 48 ounces of orange juice, four 12-ounce containers must be purchased since $4 \times 12 \text{ ounces} = 48 \text{ ounces}$. If each 12-ounce container costs \$0.95, four of these containers will cost $4 \times \$0.95 = \3.80 . The amount of money that will be saved by purchasing the 12-ounce containers is $\$4.14 - \$3.80 = \$0.34$.

15. (E) There are five digits that repeat in order. The remainder obtained by dividing the number of positions to the right of the decimal point by 5 produces the following cyclical pattern.

<i>N</i> th position to right of decimal point	Remainder when <i>N</i> is divided by 5	Repeating digit in <i>N</i> th position
1	1	3
2	2	1
3	3	7
4	4	5
5	0	2
6	1	3
7	2	1
8	3	7
9	4	5
10	0	2
...

Hence, the repeating digit (3, 1, 7, 5, or 2) that is in the *N*th decimal position is the repeating digit from the above table that corresponds to the remainder when *N* is divided by 5. For example, a remainder of 1 corresponds to the repeating digit 3, a remainder of 2 corresponds to the repeating digit 1, and so forth.

Because $968 \div 5 = 193$ remainder 3, the repeating digit 7, obtained from the above table, is in the 968th place to the right of the decimal point.

GRID-IN

1. (8) If $\frac{4\Delta}{6\Delta} + \frac{5}{17} = 1$, then $\frac{4\Delta}{6\Delta} = \frac{12}{17}$ since

$$\frac{12}{17} + \frac{5}{17} = 1.$$

Since $\frac{4\Delta}{6\Delta} = \frac{12}{17}$, 4Δ must be a multiple of 12. Hence, $4\Delta = 48$, so $\Delta = 8$.

2. (24) Since 1.5 inches represents 45 miles, 1 inch represents $\frac{45}{1.5}$ or 30 miles. Hence, 0.8 inch represents 0.8×30 or 24 miles.

3. (7) If four lemons cost \$0.68, one lemon costs $\frac{\$0.68}{4}$ or \$0.17. Since $\frac{\$1.19}{\$0.17} = 7$, there are typically seven lemons in 1 pound of lemons.

4. (15/8 or 1.88) Since \$2.50 was charged for the first $\frac{1}{2}$ mile, $\$10.75 - \2.50 or \$8.25 represents the charge for the total number of additional $\frac{1}{8}$ miles, at the rate of \$0.75 per $\frac{1}{8}$ mile. Dividing \$8.25 by \$0.75 gives the number of $\frac{1}{8}$ miles traveled. Since $\$8.25 \div \$0.75 = 11$, the taxi trip was $\frac{1}{2} + \frac{11}{8}$ miles.

Write $\frac{1}{2} + \frac{11}{8}$ as either a fraction or a decimal, and then grid in the result:

- since $\frac{1}{2} + \frac{11}{8} + \frac{4}{8} + \frac{11}{8} = \frac{15}{8}$ grid 15/8;

or

- since $\frac{1}{2} + \frac{11}{8} = 0.5 + 1.375 = 1.875$, grid 1.88.

5. (5.6) Since $\frac{288}{1,728} + \frac{1}{6}$, 288 cubic inches are equivalent to $\frac{1}{6}$ of a cubic foot. If 1 cubic foot of the metal weighs 8 pounds, then $\frac{1}{6}$ of a cubic foot will weigh

$$\frac{1}{6} \times \frac{4}{3} \text{ or } \frac{4}{3} \text{ pounds}$$

Since each pound of the metal costs \$4.20, the cost of $\frac{4}{3}$ pounds equals

$$\frac{4}{3} \times \$4.20 = 4 \times \$1.40 = \$5.60$$

Omit the dollar sign and grid 5.6.

Lesson 3-6

MULTIPLE-CHOICE

1. (D) To subtract $7\frac{3}{4}$ minutes from $9\frac{1}{3}$ minutes, first change $\frac{3}{4}$ to $\frac{9}{12}$ and $\frac{1}{3}$ to $\frac{4}{12}$.

$$9\frac{4}{12} - 7\frac{9}{12} = 8\frac{16}{12} - 7\frac{9}{12} = 1\frac{7}{12} \text{ minutes}$$

Since 1 minute = 60 seconds, $1\frac{7}{12}$ minutes = $60 + 35 = 95$ seconds.

2. (A) Since $\frac{1}{2} \div \frac{3}{4} = \frac{1}{2} \times \frac{4}{3} = \frac{2}{3}$, multiplying a number by $\frac{1}{2}$ and then dividing the result by $\frac{3}{4}$ is equivalent to multiplying the original number by $\frac{2}{3}$.

3. (D) The profit for each keychain sold is $\$1.25 - \$0.75 = \$0.50$. To make a profit of \$250, $\frac{\$250}{\$0.50} = \frac{250}{\frac{1}{2}} = 250 \times 2 =$

500 keychains must be sold.

4. (D) $\frac{3}{4}$ of $\frac{2}{3}$ of 12 = $\frac{1}{4} \times \frac{2}{3} \times \frac{12}{1} = 6$

5. (C) $\frac{2}{21}$ of $3 \times 5 \times 7 =$
 $\frac{2}{21} \times 3 \times 5 \times 7 = 10$

6. (C) You are told that $\frac{1}{4} < n < \frac{1}{3}$. Since each of the answer choices has a denominator of 24, change $\frac{1}{4}$ and $\frac{1}{3}$ into equivalent fractions that have 24 as their denominators. Since

$$\frac{1}{4} = \frac{1}{4} \cdot \frac{6}{6} = \frac{6}{24}$$

and

$$\frac{1}{3} = \frac{1}{3} \cdot \frac{6}{6} = \frac{6}{18}$$

then $\frac{6}{24} < n < \frac{8}{24}$. A possible value of n is $\frac{7}{24}$.

7. (C) It is given that $0 < x < 1$.

• If $x = \frac{1}{2}$, $\frac{1}{x} - x = 2 - \frac{1}{2} > 0$, so

Roman numeral choice I is false.

• If $x = \frac{1}{2}$, $x^2 + x^2 = \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^2 = \frac{1}{4} +$

$\frac{1}{4} = \frac{1}{2} = x$, Roman numeral choice II is false.

• Since $\frac{x}{\sqrt{x}} = \frac{\sqrt{x} \cdot \sqrt{x}}{\sqrt{x}} = \sqrt{x}$, Roman

numeral choice III is equivalent to

$\sqrt{x} > x^2$, which, after squaring both sides of the inequality, is equivalent to $x > x^4$. When $0 < x < 1$, as the exponent of x increases, the power of x decreases. Since it is true that $x > x^4$, Roman numeral choice III must be true, which makes (C) the correct choice.

8. (C) If $k = \frac{c}{\frac{a}{b}}$, then

$$k = \frac{c}{\frac{a}{b}} = c \div \frac{a}{b} = c \times \frac{b}{a} = \frac{bc}{a}$$

$$\text{so } \frac{1}{k} = \frac{a}{bc}.$$

9. (A) If an item is on sale at $\frac{1}{3}$ off the list price of d dollars, its sale price is $d - \frac{1}{3}d = \frac{2}{3}d$. If the sale price of $\frac{2}{3}d$ is reduced by $\frac{1}{4}$ of that price, then the final sale price is $\frac{2}{3}d - \frac{1}{4}\left(\frac{2}{3}d\right)$. Simplify:

$$\begin{aligned} \frac{2}{3}d - \frac{1}{4}\left(\frac{2}{3}d\right) &= \frac{2}{3}d - \frac{1}{6}d \\ &= \frac{4}{6}d - \frac{1}{6}d \\ &= \frac{3}{6}d \\ &= \frac{d}{2} \end{aligned}$$

10. (C) For the fraction $\frac{a}{b}$ to reduce to $\frac{2}{3}$, b

must be a multiple of 3. There are only three multiples of 3 between 5 and 13: 6, 9, and 12. For each of these values of b , there is one integer value for a such that the fraction reduces to $\frac{2}{3}$:

$$\frac{a}{b} = \frac{4}{6} = \frac{6}{9} = \frac{9}{12} = \frac{2}{3}$$

11. (E) *Solution 1:* If $\frac{a}{b}$ is a fraction less than 1, then its reciprocal is greater than 1. For example, $\frac{3}{4} < 1$ and $\frac{4}{3} > 1$. Since the reciprocal of $\frac{a}{b}$ may be written as

$$\frac{1}{\frac{a}{b}}, \frac{1}{\frac{a}{b}} > 1$$

two times this value, or $\frac{2}{\frac{a}{b}}$

must also be greater than 1.

Solution 2: Pick numbers for a and b that make $\frac{a}{b} < 1$. For example, let $a = 3$ and $b = 4$. Plug these numbers into each answer choice until you find the one (E) that produces a number greater than 1.

12. (B) After Juan gives $\frac{2}{3}$ of his p pencils to Roger, Juan is left with $\frac{p}{3}$ pencils. When he gives $\frac{1}{4}$ of the pencils that he has left to Maria, Juan has $\frac{p}{3} - \frac{1}{4}\left(\frac{p}{3}\right)$ pencils left. Simplify:

$$\begin{aligned}\frac{P}{3} - \frac{1}{4}\left(\frac{P}{3}\right) &= \frac{P}{3} - \frac{P}{12} \\ &= \frac{4P}{12} - \frac{P}{12} \\ &= \frac{3P}{12} \\ &= \frac{1}{4}P\end{aligned}$$

13. (C) Determine whether each Roman numeral inequality makes the statement true or false.

- I and II. If a number that is greater than 1 is raised to a power, then, as the exponent gets larger, the value of that expression also becomes larger. Thus $a^3 < a^2 < a$ is false when $a > 1$, and true when $0 < a < 1$. Hence, inequality I is false, and inequality II is true.
- III. If $-1 < a < 0$, then $a^2 > 0$ and $a < 0$, so $a^2 > a$. Therefore, $a^3 < a^2 < a$ is not true. Thus, inequality III is false.

Only Roman numeral inequality II is true.

$$\begin{aligned}p &= \left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)\left(1 + \frac{1}{4}\right)\cdots\left(1 + \frac{1}{16}\right)\left(1 + \frac{1}{17}\right) \\ &= \left(\frac{3}{2}\right)\left(\frac{4}{3}\right)\left(\frac{5}{4}\right)\cdots\left(\frac{17}{16}\right)\left(\frac{18}{17}\right) \\ &= \left(\frac{1}{2}\right)\left(\frac{1}{1}\right)\left(\frac{1}{1}\right)\cdots\left(\frac{1}{1}\right)\left(\frac{18}{1}\right) \\ &= \frac{18}{2} \\ &= 9\end{aligned}$$

5. (1/32) Replace d with its equivalent:

$$\begin{aligned}c &= 1 + \frac{1}{2} \left[1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} \right] \\ &= 1 + \underbrace{\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32}}_d\end{aligned}$$

$$c = d + \frac{1}{32}$$

$$c - d = \frac{1}{32}$$

Grid in answer as 1/32.

GRID-IN

1. (3/2) When $x = \frac{1}{2}$,

$$\begin{aligned}y &= \sqrt{\frac{x+4}{2}} = \sqrt{\frac{1}{2}\left(\frac{1}{2} + 4\right)} \\ &= \sqrt{\frac{1}{2}\left(\frac{9}{2}\right)} = \sqrt{\frac{9}{4}} = \frac{3}{2}\end{aligned}$$

Grid in as 3/2.

2. (3/4) To find what fraction of a is b , divide b by a , as in

$$\frac{5}{6} \div \frac{10}{9} = \frac{5}{6} \times \frac{9}{10} = \frac{3}{4}$$

Grid in as 3/4.

3. (625) If $25\left(\frac{x}{y}\right) = 4$, $\frac{x}{y} = \frac{4}{25}$ so $\frac{x}{y} = \frac{25}{4}$.

Hence, $100\left(\frac{y}{x}\right) = 100\left(\frac{25}{4}\right) = 25(25) = 625$.

4. (9) Express the sum inside each set of parentheses as an improper fraction. Then multiply by matching pairs of numerators and denominators that cancel out to 1, except for the denominator of the first fraction and the numerator of the last fraction: