(1) Which of the following are irrational numbers? Choose all that apply.

- a) $\sqrt[5]{7}$
- b) $\sqrt[3]{11}$

**Irrational numbers are numbers that cannot be expressed as terminating or repeating decimals.**

Ex. Any root that does not simplify to an integer: $\sqrt{3}, \sqrt[3]{5}, \sqrt[3]{10}, \sqrt[5]{7} = \sqrt[5]{7}$

*(π is also irrational)*

(2) What is the least common multiple of 63 and 105?

315

Multiply 63 by 1, 2, 3, etc.
Multiply 105 by 1, 2, 3, etc.
When you first find the same number in both lists, that is the least common multiple.

63, 126, 189, 252, 315
105, 210, 315

3) 5 kilograms is how many times more than 0.5 grams?

- d) 10000

**5 kilograms = 5000 grams**

*.5 times 10000 = 5000 grams*

4) If $\frac{1}{x}$ is greater than $\frac{1}{6}$, then which of the following could be the value of x?

- c) 5

**$\frac{1}{5}$ is greater than $\frac{1}{6}$**

*.20 > .16*
5) If $8a = 8$ and $12b = 0$, what is $a + b$?

\[
\begin{array}{c|c}
8a & 8 \\
\hline
8 & 8 \\
\hline
a & 1 \\
\end{array}
\quad
\begin{array}{c|c}
12b & 0 \\
\hline
12 & 12 \\
\hline
b & 0 \\
\end{array}
\]
\[a + b = 1 + 0 = 1\]

6) On a map, 1 inch represents 15 miles. The distance from Akron to Columbia is 105 miles. How many inches on a map would represent this distance?

\[
\begin{array}{c|c}
in_{1} & in_{2} \\
\hline
\text{mi}_{1} & \text{mi}_{2} \\
\hline
1 & x \\
\hline
15 & 105 \\
\hline
15x & = 105 \\
\hline
x & = 7 \\
\end{array}
\]

\[\pi, \sqrt[3]{27}, 3.29, \frac{3.1 + 3.2 + 3.3}{3}, \frac{59}{19}\]

7) Which of the following shows the above numbers in the correct order?

\[d) \ \frac{59}{19}, \pi, \frac{3.1 + 3.2 + 3.3}{3}, 3.29\]

\[3, 3.10, 3.14, 3.2, 3.29\]
8) What is the median of the following temperatures?

-68, -66, -65, -61, -60, -68, -60, -62, -67, -64

d) -64.5

First put the numbers in order and then look for the middle number.

-68, -68, -67, -66, -65, -64, -62, -61, -60, -60

When there is a “tie” for the middle number, take the average of the two.

\[
\frac{-65 + -64}{2} = -64.5
\]

9) Given a lake with a diameter of 50 feet surrounded by a path of uniform width of 5 feet. What is the area of the path?

c) 275π

If the diameter of the lake is 50 feet, then the radius is 25 feet. The radius of the outer (or big) circle is 25 ft. + 5 ft. = 30 feet.

Area of big circle – Area of little circle = the path

\[
\pi (r_{\text{Big}})^2 - \pi (r_{\text{Little}})^2
\]

\[
\pi (30)^2 - \pi (25)^2
\]

\[
900\pi - 625\pi
\]

\[
275\pi
\]
10) What is the distance from the intersection of the diagonals of the above rectangle and any of the four corners?

b) 26

If you look at the right triangle (in grey above) you can use the Pythagorean Theorem to find the missing side.

\[ a^2 + b^2 = c^2 \]
\[ 20^2 + 48^2 = c^2 \]
\[ 2704 = c^2 \]
\[ c = \sqrt{2704} = 52 \]

The distance from corner to corner is 52. The distance from the intersection of the diagonals to any of the corners is half of that, or 26.

11) The range of the sales for the week in the above graph is found by using which of the following two days?

b) Tuesday and Friday

The range is found by subtracting the lowest (Tuesday) from the highest (Friday).
12) Solve for $x$: \[ \frac{6}{x + 12} = \frac{-2}{x - 10} \]

a) $4.5$

\[ \frac{6}{x + 12} = \frac{-2}{x - 10} \]

\[ 6(x - 10) = -2(x + 12) \]

\[ 6x - 60 = -2x - 24 \]

\[ 8x = 36 \]

\[ x = 4.5 \]

13) A correlation was found between the temperature at an office and the number of times employees went to the bathroom. If the correlation is $-0.59$, then which of the following conclusions can be drawn?

b) As the temperature decreases, the number of bathroom visits increases.

The negative correlation shows that as one unit decreases, the other increases and v.v.

14) Which of the following is a statistical question? Choose all that apply.

- $\blacksquare$ a) How many years does an alligator live?
- $\blacksquare$ e) What is the average score on the Core test after using this book?

Choices a and e are the only one that may have more than one answer.
15) Ben’s weekly budget is $600. If he makes a circle graph and rent is represented by 225 degrees, what is his weekly rent?

\[ c) \ $375 \]

An entire circle represents 360 degrees. Find out what fraction the 225 degrees represents and multiply that by $600. Or, you can write a proportion:

\[
\frac{225}{360} = \frac{x}{600}
\]

\[360x = 225(600)\]

\[360x = 135000 \quad \text{Divide by 360}\]

\[x = \$375\]

16) A student’s score is found by dropping the two lowest grades and then averaging the rest of the scores. What is the student’s average?

\[ d) \ 80.5 \]

When we drop the two lowest grades (70 and 75) we have 4 grades left. To find the average:

\[
\frac{79 + 85 + 82 + 76}{4} = \frac{322}{4} = 80.5
\]
17) A group of 800 people are randomly selected from a population of 12,000. Given the data below, approximately how many people in the population that are at least 42 years old are pet owners?

<table>
<thead>
<tr>
<th>Age</th>
<th># of Pet Owners</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 – 29</td>
<td>189</td>
</tr>
<tr>
<td>30 – 41</td>
<td>97</td>
</tr>
<tr>
<td>42 – 53</td>
<td>214</td>
</tr>
<tr>
<td>54 – 65</td>
<td>126</td>
</tr>
<tr>
<td>Over 65</td>
<td>174</td>
</tr>
</tbody>
</table>

First add 214, 126, and 174. Total = 514
Then compare this number to the sample of 800 to find the equivalent number in the population of 12,000.

\[
\frac{514}{800} = \frac{x}{12000}
\]

\[
800x = 514 \times 12000
\]

\[
800x = 6168000
\]

\[
x = 7710
\]

e) 7710

x, 18, 51, 150, 447

18) In the sequence above, each number is three less than three times the preceding number. What is the value of x?

If 18 is 3 less than 3 times the preceding number, x, then:

\[
3x - 3 = 18 \quad \text{(add 3 to both sides)}
\]

\[
3x = 21 \quad \text{(divide both sides by 3)}
\]

\[
x = 7
\]
19) A triangle has sides of 9 and 12. Which of the following must be true?

c) The perimeter must be less than 42.

They did not say it is a right triangle so we can’t use the 3-4-5 method.

The 3\textsuperscript{rd} side of a triangle must be between the difference and the sum of the other two. Therefore, the 3\textsuperscript{rd} side must be between 12 − 9 and 12 + 9 or 3 and 21. Let’s say the 3\textsuperscript{rd} side is 21. Then the perimeter would = 9 + 12 + 21 = 42. But, since the 3\textsuperscript{rd} side has to be less than 21, the perimeter must be less than 42.

20) Which of the following graphs shows a negative slope and an y-intercept greater than the x-intercept?

d) A negative slope will rise to the left. In example d, the y-intercept is approximately 6 and the x-intercept is around 2 or 3. The y-intercept is clearly greater than the x-intercept.

21) Which of the following is a reasonable height for a 6 year old child?

c) 42 in

42 inches = 42/12 or 3.5 feet tall.
22) There are 30 marbles in a bowl. Nine are purple, five are blue, four are white, and the rest are green. What is the probability that a blue or a white marble will be selected if one marble is removed at random?

\[
\frac{\text{# of blue or white}}{\text{total}} = \frac{5 + 4}{30} = \frac{9}{30} = .30
\]
d) .30

23) If \(9c - 8d = 8c - 9d\), then what is \(c + d\)?

b) 0

\[
9c - 8d = 8c - 9d \quad \text{Get c on one side and d on the other.}
\]
\[
\begin{align*}
9c &= 8c - d + 8d \\
-8c &= -8c \\
c &= -d
\end{align*}
\]

Since \(c = -d\), we can replace it in the expression \(c + d\):

\[
\begin{align*}
c + d &= ? \\
-d + d &= 0
\end{align*}
\]
24) Which of the following is equivalent to $21x^3$?
Choose all correct answers.

- a) $10x^3 + 9x^3 + 2x^3 = 21x^3$  Add coefficients, leave exponents alone
- b) $7\left(3x^2\right) = 21x^2$
- c) $(3x)(7x^2) = 21x^3$  Multiply 3 $\cdot$ 7, add exponents
- d) $\frac{63x^4}{3x^1} = 21x^3$  Divide 63 by 3, subtract exponents
- e) $\frac{21x^3}{x^1} = 21x^2$  Subtract exponents

$$f(x) = \{(21,3), \ (5,21), \ (13,3), \ (14,5), \ (21,5)\}$$

25) If one ordered pair is removed from the list above, $f(x)$ becomes a function. Which of the following will satisfy this? Choose all correct answers.

- a) (21, 3)  In order to be a function, no x term may be repeated. (The x term is the first number and the y is the second number.)
- e) (21, 5)  Since there are two terms with a first number of 21, removing either one (a or e) will make $f(x)$ a function.
26) Which of the following is equivalent to \( \frac{k}{5} \div \frac{m}{15} \)?

\[ \frac{k \div m}{5 \div 15} = \frac{k}{5} \cdot \frac{15}{m} = \frac{3k}{m} \]

b) \( (k) \left( \frac{3}{m} \right) \)

Unfortunately, this is not one of the choices so we have to look for an equivalent answer!

\[ \frac{3k}{m} - (k) \left( \frac{3}{m} \right) \text{ because } \left( \frac{k}{1} \right) \left( \frac{3}{m} \right) = \frac{3k}{m} \]

27) If the number 14.738952 is multiplied by 1000, what will be the digit in the hundredths place?

c) 5

\[ 14.738952 \times 1000 = 14738.952 \]

The digit in the hundredths place is 5.

28) A group of 260 students were polled about watching T.V. One hundred and five said they watched Game of Thrones and 185 said they watched Homeland. Fifteen students said they watched neither. How many students watched both shows?

a) 45

First subtract the 15 that did not watch either show.

260 – 15 = 245

Then add: 105 + 185 = 290.

Since only 245 students watched the shows: 290 – 245 = 45
29) A bag contains red, white, and blue marbles. There are 10 red marbles and 15 blue marbles. If the probability of choosing a red marble is $\frac{2}{7}$, how many white marbles are in the bag?

   \[2 \cdot \frac{10}{7} = \frac{T}{T} \]
   \[2T = 70\]
   \[T = 35\]

   The total number of marbles is 35.

   \[35 - 10 \text{ red} - 15 \text{ blue} = 10 \text{ white marbles}.\]

   \[d) \ 10\]

30) What is $2.9 \times 10^{10} + 3.07 \times 10^{11}$? (Answer in scientific notation.)

   \[\text{Change } 2.9 \times 10^{10} \text{ to } .29 \times 10^{11}.\]
   \[(\text{If we make the number } 1 \text{ decimal place smaller, we have to make the exponent } 1 \text{ number larger.})\]
   \[.29 \times 10^{11}\]
   \[+ \ 3.07 \times 10^{11}\]
   \[
   \underline{3.36 \times 10^{11}}
   \]
31) What is the value of $x$ in the drawing above?

\[ 30 + x + 43 = 180 \]
\[ x = \boxed{107} \]

First find the missing angle in the triangle on the left.
\[ 180 - 60 - 90 = 30 \]

Then find the missing angle in the triangle on the right.
\[ 180 - 47 - 90 = 43. \]

Finally, the three angles that form a straight line also have to have a sum of 180.
\[ 30 + x + 43 = 180 \]
\[ x + 73 = 180 \]
\[ x = 107 \]

32) If 60 is $p$ percent of 80, what is $p$ percent of 120?

\[ \frac{60}{80} = \frac{x}{120} \]
\[ 80x = 7200 \]
\[ x = 90 \]

\[ 7 \]

\[ \frac{4}{7} \]

\[ \frac{4}{7} = .57 \quad \frac{7}{11} = .64 \]

Therefore, \( \frac{4}{7} \) is less than \( \frac{7}{11} \).

Choice e.

\[ \frac{4}{7} = .57 \quad \frac{7}{11} = .64 \]

Therefore, \( \frac{4}{7} \) is less than \( \frac{7}{11} \).

Choice e.
34) If you can buy 8 apples for d dollars, which of the following represents the cost of 17 apples?

\[
\text{apples \quad $} = \text{apples \quad $} \\
8 \qquad d \quad \quad 17 \qquad x \\
\frac{8}{d} = \frac{17}{x} \quad \text{Solve for x.}
\]

\[
8x = 17d \\
x = \frac{17d}{8}
\]

35) The ratio of cars to trucks on a highway at 6 p.m. is 9 to 5. Which of the following could be the total number of cars and trucks on the highway at that time?

c) 182

\[
9x + 5x = 14x
\]

The answer must be a multiple of 14.
Choice c) 182 is the only number that 14 will go into evenly.

36) If the circumference of a circle is \(8\pi\), which of the following is the area of the circle?

b) \(16\pi\)

\[
C = \pi d \\
8\pi = \pi d \quad \text{Divide both sides by } \pi. \\
8 = d \quad \text{If the diameter is 8, then the radius = 4.}
\]

\[
A = \pi r^2 \\
A = \pi (4)^2 \\
A = 16\pi
\]
37) \( \frac{4}{9} + x = 6 \) Solve for \( x \) and write your answer as a fraction.

\[
\frac{4}{9} + x = 6 \quad \text{Subtract} \quad \frac{4}{9} \quad \text{from both sides.}
\]

\[
x = 6 - \frac{4}{9} \quad \text{You can get a common denominator}
\]

\[
\text{or, use the simple 1 - 2 - 3 method from Lesson 1!}
\]

\[
6 - \frac{4}{9} = 6 \cdot \frac{9 - 4 \cdot 1}{1} = \frac{54 - 4}{9} = \frac{50}{9}
\]

38) Raygene sold $68,500 worth of cars on Monday and $125,355 on Tuesday. What was her percent increase?

\[
d) \quad 83% \\
\text{difference: } \$125,355 - \$68,500 = \$56,855 \\
\frac{\text{difference}}{\text{original}} = \frac{x}{100} \\
\frac{56855}{68500} = \frac{x}{100} \\
68500x = 5685500 \\
x = 83
\]

39) A cube has an edge of 9 cm. If you remove 4 cubes of edge 3 cm, one from each corner at the top of the cube, what will be the volume of the remaining solid?

\[
\text{Volume of a "box" = length \cdot width \cdot height} \\
\text{In a cube, the length, width, and height are the same.} \\
\text{Each is called an "edge".} \\
\text{Large cube minus 4 small cubes:} \\
9 \cdot 9 \cdot 9 - 4(3 \cdot 3 \cdot 3) \\
729 - 4(27) \\
729 - 108 \\
621 \\
d) \quad 621
\]
40) If 100 bags of grass weigh \( g \) ounces, which of the following represents the weight of 20 bags of grass?

\[
\text{c) } \frac{g}{5}
\]

We need to pick *another* letter for the unknown weight. Let’s call it \( x \). Then write a proportion and solve it for \( x \!:
\[
\frac{\text{grass}}{\text{ounces}} = \frac{\text{grass}}{\text{ounces}} \\
\begin{align*}
100 & = 20 \\
g & = x \\
100x & = 20g \\
x & = \frac{20g}{100} \\
x & = \frac{g}{5}
\end{align*}
\]

41) Shelby walked 11 meters north, then 24 meters west, and then 7 meters north. What is the shortest distance between the place she started and the place she finished?

\[
\text{b) } 30
\]

Draw a triangle as shown above. It is a right triangle since to go North and then West is a 90 degree turn.

Long way: Solve \( 18^2 + 24^2 = c^2 \)

Short way: Recognize the sides are multiples of the \( 3 - 4 - 5 \) triangle.

\[
\begin{align*}
&3 - 4 - 5 \\
x6 & \quad x6 \quad x6 \\
&18 - 24 - 30
\end{align*}
\]
42) Car X travels from town A to town B at \( z \) miles per hour.

Car Y travels from town A to town B at \( \frac{z}{3} \) miles per hour.

Which of the following is a true statement?

b) It takes car X one-third as long to travel from town A to town B as it takes car Y.

Since car Y is traveling \( \frac{1}{3} \) as fast as car X, it will take car Y three times as long to travel as car X. Or, the other way around, it will take car X \( \frac{1}{3} \) as long as car Y.

43) Based on the graph, if \( p \) represents the cost for the first hour of parking in a garage and \( h \) represents the cost for each additional hour of parking, what are the values of \( p \) and \( h \)?

b) \( p = 7, \ h = 1 \)

Notice the first two dots = (1,7) and (2,8). This means it costs $7 for the first hour (p) and since the price goes up $1 for the 2nd hour, the hourly rate (h) is $1.
44) A tin can is open at the top. The base has a diameter of 40 cm and the height of the can is 50 cm. How many square centimeters of tin are required to make the can?

a) 7536

Since the diameter of the base is 40 cm, the radius is 20 cm.
Bottom = circle = \( \pi r^2 = 3.14 \times (20)^2 = 1256 \)
Think of cutting the can open and making it flat.
The side opened up = rectangle with width = circumference of base and length = 50 cm.
Side = length \( \times \) width = 50 \( \times \pi d = 50 \times 3.14 \times 40 = 6280 \)

Total: 1256 + 6280 = 7536

45) Which of the tables below represents the points in the graph above?

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

The ordered pairs representing each dot are: (1,3), (2,4), (3,6), (4,5) and (5,1).
46) In the triangle above, x could be any number except:

The 3rd side of a triangle must be between the difference and the sum of the other two sides.

\[ 10 - 10 < x < 10 + 10 \]

\[ 0 < x < 20 \]

So, the 3rd side can be any number between 0 and 20.

The only choice that is not between 0 and 20 is **e) 20**.

47) A tank held 8000 gallons of water at 8:15 a.m. and was emptied to 750 gallons of water at 7:05 p.m. What was the rate of emptying in gallons per hour?

**d) 669.4**

\[
\begin{align*}
8000 - 750 &= 7250 \text{ gallons} \\
8:15 \text{ a.m. to 7:05 p.m.} &= 12 \text{ hours} - 1 \text{ hour} - 10 \text{ minutes} = 10 \text{ hours} 50 \text{ minutes} = 10 \text{ hours} + \frac{50}{60} \text{ hours} = 10.83 \text{ hours} \\
\frac{7250 \text{ gallons}}{10.83 \text{ hours}} &= 669.4 \text{ gallons/hour}
\end{align*}
\]
48) The four points above lie on a line. The line is the graph of which of the following equations?

\[
y = \frac{5}{3}x + 5
\]

If you imagine extending the line through the points, it should hit the y-axis at 5 not negative 5. In the equation \( y = mx + b \), the \( b \) or last number is the y-intercept. The line is rising to the right so the slope is positive. The slope, or rise over run, is up 5 and over 3.
You have to look at the units on both axis and notice that they are not the same. Up 5 and over 3 = a slope \((m)\) of \(5/3\).

49) A sphere is cut in half creating a hemisphere. The area of the shaded disk is \(144\pi\). Find the volume of the hemisphere.

Formula for volume of a sphere: \( V = \frac{4}{3}\pi r^3 \)

\[ b) \ 1152\pi \]

Volume of a hemisphere = 1/2 the volume of a sphere.
Half of 4/3 is 2/3!
First we have to find the radius. The "disk" is a circle.

\[ \text{Area}_{\text{circle}} = \pi r^2 \]

\[ 144\pi = \pi r^2 \]

\[ 144 = r^2 \]

\[ 12 = r \quad \text{Now plug this into the formula:} \]

\[ V_{\text{hemisphere}} = \frac{2}{3}\pi r^3 = \frac{2}{3}\pi (12)^3 = 1152\pi \]
50) A triangle is cut out of a rectangle as shown above. What is the area of the remaining shaded region?

The length of the rectangle = 14 + 10 = 24.
The width of the rectangle = 16.
The base of the triangle = 24 – 4 – 6 = 14
The height of the triangle = width of rectangle = 16
Area of shaded = Area of rectangle – Area of triangle

\[ \text{Area of shaded} = \text{length} \times \text{width} - \frac{1}{2} \times \text{base} \times \text{height} \]

\[ = (24)(16) - \frac{1}{2}(14)(16) = 272 \]

51) Dr. Gardner is shipping her book to a college. She has 1,558 books ordered and boxes which will hold 25 books. She has 50 empty boxes ready to be packed. How many more boxes does she need?

\[ 1558 \div 25 = 62.32 \]
\[ 62.32 - 50 = 12.32 \]

You might think she needs only 12 boxes but then she would have some books left over that would not fit. Therefore, she needs 13 boxes.
52) The diagram above shows the number of hot dogs eaten in a contest.

The total number of hot dogs eaten was 3,920.

If △ represents one-fourth (.25) of a hot dog, □ represents one-half (.5) of a hot dog, and ▤ represents three-fourths (.75) of a hot dog, how many hot dogs does each □ represent?

\[
\frac{7 + 6.75 + 6.25 + 4.5}{24.5} = 160
\]

b) 160

53) If triangle ABC is reflected across the x-axis, which of these will be the coordinates of triangle A′B′C′?

\[d) \ A′(−3, 6) \quad B′(−6, 2) \quad C′(−9, 8)\]
54) Which of the graphs below shows a positive correlation?

Rising to the right shows a positive correlation.

55) Solve for $x$: $\sqrt{x + 1.4} - 12 = 3$

\[
\begin{align*}
\sqrt{x + 1.4} - 12 &= 3 \\
\sqrt{x + 1.4} &= 15 \\
(x + 1.4)^2 &= (15)^2 \\
x + 1.4 &= 225 \\
x &= 223.6
\end{align*}
\]

56) Based on the graph below, how many people got at least 1 question right?

At least 1 question right means 1 or more:

1: 20
2: 15
3: 15
Total = 20 + 15 + 15 = 50

e) 50