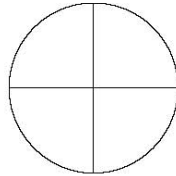


Grade 5 – Algebraic Relationships

Circle Parts

The radius of a circle is 5 inches, the diameter is 10 inches, and the circumference is 31.5 inches. The second circle has a radius of 5.5 inches, a diameter of 11 inches, a circumference of 34.5 inches. The third circle has a radius of 6 inches, a diameter of 12 inches and a circumference of 37.5 inches. What will be the diameter and circumference of a circle, which has a radius of 9 inches?



El radio de un círculo mide 5 pulgadas, su diámetro mide 10 pulgadas y su circunferencia mide 31.5 pulgadas. El segundo círculo tiene un radio de 5.5 pulgadas, un diámetro de 11 pulgadas y una circunferencia de 34.5 pulgadas. El tercer círculo tiene un radio de 6 pulgadas, un diámetro de 12 pulgadas y una circunferencia de 37.5 pulgadas. ¿Cuál será el diámetro y la circunferencia de un círculo con un radio de 9 pulgadas?

Радиус круга составляет 5 инчей, диаметр составляет 10 инчей, а окружность – 31.5 инча. Радиус второго круга составляет 5.5 инча, диаметр составляет 11 инчей, а окружность – 34.5 инча. Радиус третьего круга составляет 6 инчей, диаметр составляет 12 инчей и окружность – 37.5 инча. Какими будут диаметр и окружность круга с радиусом 9 инчей?

The problem said the first circles circumference is 31.5.

The second circles is 34.5

The third circles is 37.5

Put into a chart

| circle# | radius | diameter | circumference |
|---------|--------|----------|---------------|
| 1 | 5 | 10 | 31.5 |
| 2 | 5.5 | 11 | 34.5 |
| 3 | 6 | 12 | 37.5 |
| 4 | 6.5 | 13 | 40.5 |
| 5 | 7 | 14 | 43.5 |
| 6 | 7.5 | 15 | 46.5 |
| 7 | 8 | 16 | 49.5 |
| 8 | 8.5 | 17 | 52.5 |
| 9 | 9 | 18 | 55.5 |

the radius goes up by half
the diameter goes up by one
the circumference goes up by 3

Verification

the diameter is always 2 times the radius
 $9 \times 2 = 18$

the circumference is the diameter times π

π is 3.14

$$18 \times 3.14 = 56.52$$

my two answers don't match

| circle# | radius | radius $\times 2 =$ diameter | diameter $\times 3.14 =$ circumference |
|---------|--------|------------------------------|--|
| 1 | 5 | 10 | 31.4 close to 31.5 |
| 2 | 5.5 | 11 | 34.54 close to 34.5 |
| 3 | 6 | 12 | 37.68 farther from 37.5 |
| 9 | 9 | 18 | 56.52 matches |

in the facts given the diameter wasn't multiplied to get the circumference

$$\begin{array}{r} 31.5 + 3 = 34.5 - 2 \\ +3 \quad 37.5 - 3 \\ \quad 40.5 - 4 \\ \quad 43.5 - 5 \\ \quad 46.5 - 6 \\ \quad 49.5 - 7 \\ \quad 52.5 - 8 \\ \quad 55.5 - 9 \end{array}$$

answer 9 radius
18 diameter
55.5 circumference

D, R, C of a Circle

KEY CONCEPTS

Patterning (0.5 r, 1 d, 3 c) relationship--Diameter is $2r$

Ratio of r or d to circumference – growth of circle

2 or 3 patterns are needed to reach solution

Visualize the relationship between r , d , c – the horizontal and vertical growth related to the increase.

5 – 2 – 1

- CU 6 The translation of the key concepts is shown in the rules for the patterns written beside the bracket. This is made enhanced by the extension in verification to using pi to find the circumference from the diameter.
- PS 6 The process of creating a table of the dimensions and using the growing patterns to extend the table to the required radius of 9 is made thoroughly developed by the description of the pattern and then is enhanced by the use of pi in the verification to find the circumference.
- V 6 The second look at the solution includes using a different perspective (pi) to find the dimensions by formula – making it enhanced. This is further supported by his/her checking of the givens when pi is used and finding different measures for the circumference – and then checking to be certain the original patterns were extended without error.
- C 6 The connecting path is enhanced with the labels on the charts, the description of the growing patterns, and the steps following “my two answers don’t match” to get to the identified answer --- allowing the reader to move easily and make connections from one thought to another.
- Acc. 5 A radius of 9 yielding a diameter of 18 and a circumference of 54 is mathematically justifiable and supported by the work. [In addition, a radius of 9 yielding a diameter of 18 and a circumference of 56.52 is mathematically justifiable and supported by the work.]

Retell

every other circle adds half an inch to the radius one inch to the diameter and adds three inches to the circumference beginning with a circumference of 31.5 inches a diameter of 10 inches and a radius of 5 inches what will the circumference be of a circle with a radius of 9 inches?

| <u>radius</u> | <u>circumference</u> |
|---------------|----------------------|
| 5.0 | 31.5 |
| 5.5 | 34.5 |
| 6.0 | 37.5 |
| 6.5 | 40.5 |
| 7.0 | 43.5 |
| 7.5 | 46.5 |
| 8.0 | 49.5 |
| 8.5 | 52.5 |
| 9.0 | 55.5 |

Solution the circumference is 55.5

Verification

how many times it took

$$\rightarrow 8 \times 3 = 24$$

how much added every time

$$\begin{array}{r} 31.5 \\ + 24 \\ \hline 55.5 \end{array}$$

$$0.5 \times 8 = 4$$

$$4 + 5.0 = 9.0$$

D, R, C of a Circle

KEY CONCEPTS

Patterning (0.5 r, 1 d, 3 c) relationship--Diameter is $2r$

Ratio of r or d to circumference – growth of circle

2 or 3 patterns are needed to reach solution

Visualize the relationship between r, d, c – the horizontal and vertical growth related to the increase.

5 – 2 – 2

- CU 5 The translation (the prose at the top of the page) of the key concepts (patterning of the radius, diameter, and the circumference; each pattern growing at different rates) is made thoroughly developed by the equation used in verification to get to the requested diameter.
- PS 3 The process of finding the circumference of the circle with a radius of 9 is thoroughly developed, but the process of finding the diameter for the same circle is ineffective although it is described in the prose. Together, these make the process only partially useful.
- V 4 The second look uses a different perspective to verify the measure of the circumference as well as the number of steps between the initial circle and the requested one. This second look, completely reviews his/her original solution. Unfortunately, the readers assume s/he didn't re-read the task – or notice s/he forgot to find the diameter of the requested circle.
- C 4 The path connecting the translation (prose) to the process used (creating an organized table of growing patterns) to the verification (using a different perspective to determine the circumference) to the identified solution is complete.
- Acc. 4 55.5 is the mathematically justifiable solution to the circumference of the circle with radius of 9. S/he is able to describe the pattern needed to find the diameter. The methods used to find the pattern of the radius provides the evidence that no additional instruction appears necessary.

The circumference will be 40.5 inches because it adds

3 in. every time. The diameter will be 13 in. because

it adds one in. every time. The radius will be 9 inches.

The diameter will be 13 in.

The circumference will be 40.5 in.

The circumference will be 40.5 because it adds 3 in. every time.

$$\begin{array}{r} 31.5 \\ + 3 \\ \hline 34.5 \\ + 3 \\ \hline 37.5 \\ + 3 \\ \hline 40.5 \end{array}$$

The diameter will be 13 in because it adds one every time.

$$\begin{array}{r} 10 \\ + 1 \\ \hline 11 \\ + 1 \\ \hline 12 \\ + 1 \\ \hline 13 \end{array}$$

The diameter will be 13 in and the circumference will be 40.5 in.

D, R, C of a Circle

KEY CONCEPTS

Patterning (0.5 r, 1 d, 3 c) relationship--Diameter is $2r$

Ratio of r or d to circumference – growth of circle

2 or 3 patterns are needed to reach solution

Visualize the relationship between r , d , c – the horizontal and vertical growth related to the increase.

5 – 2 – 3

- CU 2 The translation included the key concepts of patterning for diameter and circumference (but just from the givens to the next step – partially completed), each pattern growing at different rates, BUT inappropriately translates the pattern of the growing radius. Together, these make the translation underdeveloped.
- PS 3 The process of discovering the patterns within the given dimensions and extending that pattern is only partially useful when s/he determines the pattern only goes one more step (or when s/he determines the pattern for the radius can be ignored).
- V 1 There is no evidence of a second look. Although s/he may believe the part above the line is the original solution and the part below is the verification, when s/he only provides evidence of one solution process, there is not second look.
- C 4 The path connecting the translation (the prose identifying the amounts each pattern grows) to the process (applying the growing patterns) to the identified solution is complete.
- Acc. 1 A diameter of 13 and a circumference of 40.5 is not mathematically justifiable for the radius of 9.