Name: Date: Period:

Score:	First attempt due:
	Final corrections due:

Practice Worksheet:
Properties of Exponents

Simplify each expression completely using properties of exponents. Answers should have positive exponents only and all numbers evaluated, for example $5^3 = 125$. Each set of problems will use the property listed above as well as a combination of properties attempted in previous sets.

NEGATIVE EXPONENT AND ZERO EXPONENT PROPERTIES

1. $a^{-7} =$	2. $(21c^{18})^{-1} =$	3. $(3d^2)^0 =$	4. $5(x^0)y^{-1} =$
$\left(\frac{1}{a}\right)^7 = \frac{1}{a^7}$	$\left(\frac{1}{21c^{18}}\right)^1$	1	$5\,\frac{1}{y} = \frac{5}{y}$

PRODUCT OF POWERS PROPERTY

$(-4d^{14})$

5. $a^7a^{12} =$	6. $c^3c^8c^{-5} =$	7. $(2d^7)(-4d^9d^5) =$	8. $(9x^{10}y^3)(-x^5y^3) =$
a^{19}	c^6	$-8d^{21}$	$-9x^{15}y^6$

QUOTIENT OF POWERS PROPERTY

9. $\frac{a^{12}}{a^7} =$	10. $\frac{6c^3}{3c^{-5}} =$	11. $\frac{2d^7}{-4d^9d^5} = \frac{2d^7}{-4d^{14}}$	12. $\frac{9x^{10}y^3}{-x^5y^3} =$
a^5	$2c^8$	$-\frac{1}{2}d^{-7} = -\frac{1}{2d^7}$	$-9x^5y^0$ $-9x^5$

POWER OF A POWER PROPERTY

13. $(a^3)^4 =$	14. $(c^{-1})^3 =$	15. $(d^5)^{-2} =$	16. $(6x^3y)(x^2)^{-2} =$
a^{12}	$c^{-3} = \frac{1}{c^3}$	$d^{-10} = \frac{1}{d^{10}}$	$(6x^3y^1)(x^{-4})$ $= 6x^{-1}y^1$ $= \frac{6y^1}{x^1}$

Power of a Product Property

17. $(8a^5)^2 =$

$8^2(a^5)^2$

$=64a^{10}$

18. $(2c^{-1})^{-3} =$

$2^{-3}c^3$

$=\frac{c^3}{2^3}=\frac{c^3}{8}$

19. $(-2d^{10})^{-2} =$

$(-2)^{-2}d^{-20}$

$=\frac{1}{4d^{20}}$

$\frac{1}{(-2)^2}d^{20}$

20. $(4x^2y^3)^{-2}(-x^{10})^2 =$

$(4^{-2}x^{-4}y^{-6})(-1^2x^{20})$

$(\frac{1}{16}x^{-4}y^{-6})(x^{20})$

$\frac{1x^{16}}{16y^6}$

Power of a Quotient Property

21. $\left(\frac{a}{2}\right)^4 =$

$\frac{a^4}{2^4}=\frac{a^4}{16}$

22. $\left(\frac{25c^{-1}}{5}\right)^2 =$

$(5c^{-1})^2$

$=25c^{-2}=\frac{25}{c^2}$

23. $\left(\frac{-2d^{11}f^5}{4d^{-2}f^2}\right)^2 =$

$\left(-\frac{1}{2}d^{13}f^3\right)^2$

$\frac{d^{26}f^6}{4}$

24. $\left(\frac{(-2x)^2}{3xy^2}\right)^3 =$

$\left(\frac{4x^2}{3xy^2}\right)^3$

$=\left(\frac{4x}{3y^2}\right)^3=\frac{64x^3}{27y^6}$

More Practice with Mixed Properties

25. $\left(\frac{a}{2}\right)^4\frac{(8a^5)^2}{a^{-1}a^{10}} =$

$\frac{a^4}{16}\cdot\frac{64a^{10}}{a^9}$

$=4a^5$

26. $\left(\frac{16c^6c^{-2}}{(2c^2)^3}\right)^{-1} =$

$=\left(\frac{(2c^2)^3}{16c^6c^{-2}}\right)^1$

$=\frac{8c^6}{16c^4}=\frac{1c^2}{2}$

27. $\frac{-2f}{d^5}\left(\frac{df^5}{-2f^{10}}\right)^2 =$

$=\frac{-2f^1}{d^5}\left(\frac{d^2f^{10}}{4f^{20}}\right)$

$=\frac{-1}{2d^3f^9}$

28. $\left(\frac{(4x^2y^3)^0}{-3x^{-1}y^2}\right)^3 =$

$\left(\frac{1}{-3x^{-1}y^2}\right)^3$

$=\frac{1}{-27x^{-3}y^6}$

$\frac{x^3}{-27y^6}$

Bonus Questions

29. $\left(\frac{9}{20}d^5\right)\left(\frac{2}{1}d^{-2}\right)\left(\frac{4}{3}d^9\right)$

$=\frac{72}{60}d^{12}$

$=\frac{72d^{12}}{60}=\frac{6d^{12}}{5}$

30. $\frac{8(-1m^0n^2)^3(-1n^3)^2}{m^6n^0(-2m^{-2}n^4)^3}$

$=\frac{8(-1m^0n^6)(-1n^6)}{m^6n^0(-2^3m^{-6}n^{12})}$

$=\frac{-8}{-8}m^0n^0=1$

5.1.1: Going Around the Curve

Experiment A

A particular mould grows in the following way: If there is one "blob" of mould today, then there will be 4 tomorrow, 9 the next day, 16 the next day, and so on.
Model this relationship using linking cubes.

Purpose

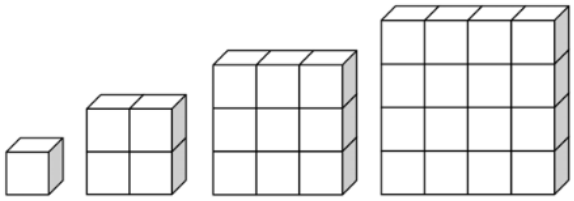
Find the relationship between the side length and the number of cubes.

Hypothesis

What type of relationship do you think exists between the side length and the number of cubes?

Procedure

1. Build the following sequence of models, using the cubes.

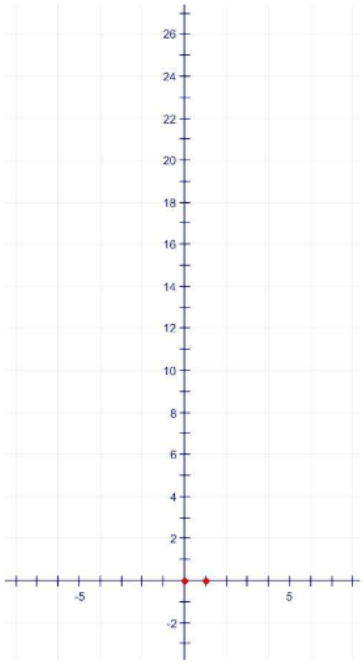


2. Build the next model in the sequence.

Mathematical Models

Complete the table, including first and second differences.
Make a scatter plot and a line of best fit.

Side Length	Number of Cubes	First Differences	Second Difference
0	0		



5.1.3: Going Around the Curve

Experiment C

A particular mould grows in the following way: If there is one "blob" of mould today, then there will be 3 tomorrow, and 6 the next day.
Model this relationship using linking cubes.

Purpose

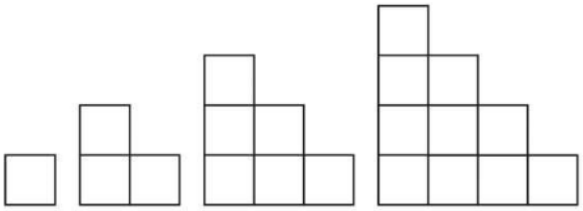
Find the relationship between the number of cubes in the bottom row and the total number of cubes.

Hypothesis

What type of relationship do you think exists between the number of cubes in the bottom row and the total number of cubes?

Procedure

1. Build the following sequence of models using the cubes.

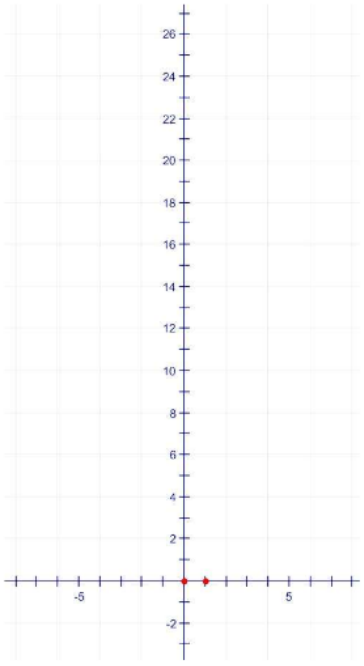


2. Build the next model in the sequence.

Mathematical Models

Complete the table, including first and second differences.
Make a scatter plot and a line of best fit.

Number of Cubes in the Bottom Row	Total Number of Cubes	First Differences	Second Difference



5.1.4: Going Around the Curve

Experiment D

Luisa is designing an apartment building in a pyramid design. Each apartment is a square. She wants to know how many apartments can be built in this design as the number of apartments on the ground floor increases.
Model this relationship, using linking cubes.

Purpose

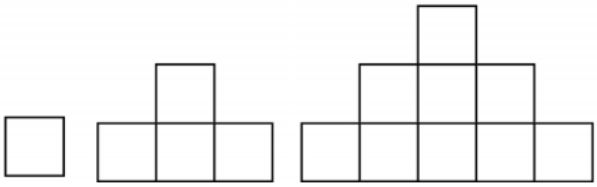
Find the relationship between the number of cubes in the bottom row and the total number of cubes.

Hypothesis

What type of relationship do you think exists between the number of cubes in the bottom row and the total number of cubes?

Procedure

1. Build the following sequence of models using the cubes.

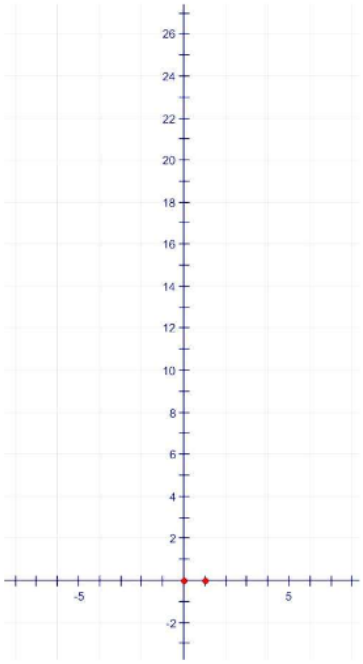


2. Build the next model in the sequence.

Mathematical Models

Complete the table, including first and second differences.
Make a scatter plot and a line of best fit.

Number of Cubes in the Bottom Row	Total Number of Cubes	First Differences	Second Difference
0	0		



5.1.5: Going Around the Curve

Experiment E

Liz has a beautiful pond in her yard and wants to build a tower beside it using rocks. She is unsure how big she will make it and how many rocks she will need. She is particularly concerned to have the nicest rocks showing.
Model the relationship comparing the length of the base to the number of visible rocks using linking cubes.

Purpose

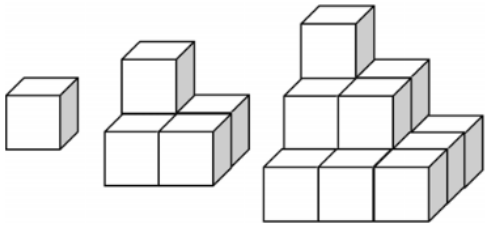
Find the relationship between the number of cubes on the side of the base and the total number of unhidden cubes.

Hypothesis

What type of relationship do you think exists between the length of the side of the base and the number of visible cubes?

Procedure

1. Build the following sequence of models using the cubes.



2. Build the next model in the sequence.

Mathematical Models

Complete the table, including first and second differences.
Make a scatter plot and a line of best fit.

Length of Side of Base	Total Number of Unhidden Cubes	First Differences	Second Difference