Learning Outcome:
This lesson explores properties of exponents, use of the properties to generate equivalent expressions, and solving problems using relations.
8.EE.A.1

Your basic ideas of exponents helped you to bring success to Prochips.
Now practice some more challenges on exponents.

1 Find the missing numbers :

$\frac{3}{4}, \frac{5}{4}, \boxed{\frac{7}{4}}, \frac{9}{4}, \boxed{\frac{11}{4}}, \frac{13}{4}$

2 Arrange the given expressions in the ascending order: $\frac{3^9}{3^6}$, $3^5 \times 3^{-5}$, $\frac{3^3}{3^6}$, 3^7

3^{-3} | 1 | 3^3 | 3^7

3 How long would sunlight take to reach Earth, if Earth is 15×10^7 km away from the Sun and light travels through space at the speed of 3×10^5 km/sec? [Time= Distance/Speed]

5×10^2 sec

4 Match the expressions given on the left side with its simplest form on the right.

$\frac{5^8}{5^{12}}$	3	○	5^{10}
$5^4 \times 5^6$	1	○	10^8
5^0	4	○	5^{-4}
$2^8 \times 5^8$	3	○	1

5 Find the area of a playground, whose length is 2^7 meters and width is 2^5 meters.

2^{12} meters^2

6 Find the simplest form of the expression $\frac{(m+n)^2}{(m^2-n^2)}$.

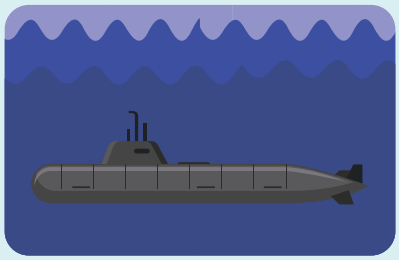
☐ $\frac{(m-n)}{(m+n)}$ ☑ $\frac{(m+n)}{(m-n)}$ ☐ $(m+n)(m-n)$ ☐ $(m+n)+(m-n)$

Application

Learning Outcome:
This lesson explores properties of exponents, use of the properties to generate equivalent expressions, and solving problems using relations.
8.EE.A.1

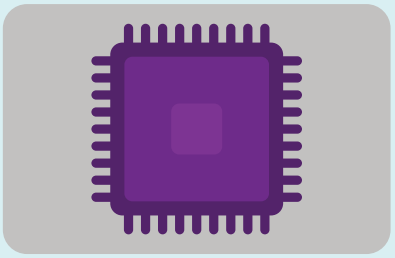
You have become an expert in using exponents. Your contribution to Prochips was awesome. With that wide knowledge, explore more on exponents by answering the following questions.

1 A submarine begins its descent from the surface of the water and it dives 20 feet for each minute. What would be the depth of the submarine after $\frac{2}{3}$ hours?



800 feets ✓

2 After research, it was decided that the weight of the chip shouldn't exceed 0.4×10^{7} g. If they used x transistors, each weighing 0.002 g to meet the requirement, find the maximum value of x.



2×10^{9} transistors ✓

3 A chip that can house 10^{7} transistors per mm sq is fabricated such that it covers an area of 1 sq cm. Find the total number of transistors that it'll have.

$10^{8} \rightarrow 10^{9}$

1 cm = 10 mm
$1\ cm^2 = 10 \times 10\ mm^2$

4 Match each value with the most appropriate measurement.

millimeter < inches < meter < miles

2.6×10^{2} meters	4	○	Depth of bathtub
2.5×10^{5} miles	3	○	Length of memory chip
1.6×10^{1} inches	1	○	Distance between two asteroids
7.8×10^{0} millimeters	2	○	Height of a skyscraper

5 While renovating the bathroom, it was observed that the amount of water that flowed from a faulty showerhead was 24^{-1} liters per second. If a person takes 20 min on an average to take a shower, how much water would be used during this time?

50 liters ✓

6 Chip A is stacked up with 2020^{2} transistors. Chip B is stacked up with 2019^{2} transistors. What would be the ratio of number of transistors in chip A to chip B?

$\text{Ratio} = \frac{\text{chip A}}{\text{chip B}} = ?$

Learning Outcome:
This lesson explores properties of exponents, use of the properties to generate equivalent expressions, and solving problems using relations.
8.EE.A.1

Discuss in class

We have sound coming from an external source up to the window of the room. At the time it reaches the window the level of the sound is about 20 dBA. We want to develop a soundproof window so that by the time the sound reaches inside the room it should be less than 2 dBA. When sound travels through air, its intensity reduces. The intensity is inversely proportional to the square of the distance from source.

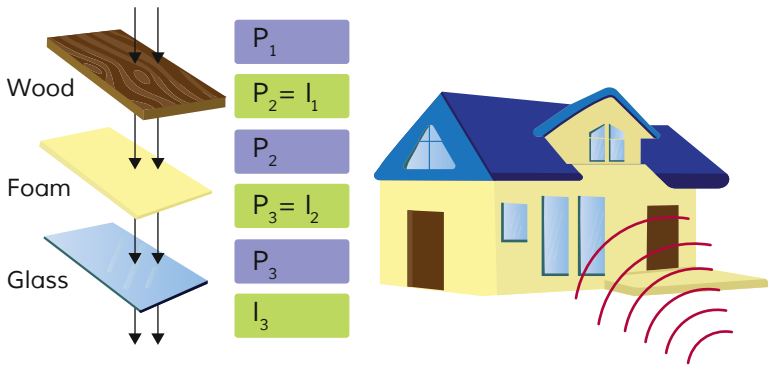
For sound travelling through air intensity $I = \frac{P \times 0.08}{r^2}$, where P is the original intensity of sound at source, I is the intensity of sound at the destination at a distance r from source.

We can use a sheet of wood, foam, and glass to develop the soundproof window. (Each has a different level of sound absorption.)

- Wood -> intensity $I_1 = \frac{P_1 \times 0.7}{r_1^2}$
- Foam -> intensity $I_2 = \frac{P_2 \times 0.05}{r_2^2}$
- Glass -> intensity $I_3 = \frac{P_3 \times 0.95}{r_3^2}$

You decide to have a sheet of wood, foam, and glass one after the other as shown below.

P_1 = P (Intensity outside room 20dBA)



$I = I_3$ (Intensity inside room 2 dBA)

- P - Intensity outside and same as P_1
- Sound travels through wood, intensity reduces to I_1 - same as P_2
- Sound travels through foam, intensity reduces to I_2 - same as P_3
- Sound travels through glass, intensity reduces to I_3 - same as the intensity of sound inside the room

What should be the thickness (the value of r in each case in inches) of each layer made of wood, foam, and glass so that the level of the sound is reduced from 20 dBA to just 2 dBA?

Wood			Foam			Glass		
P_1	r_1	I_1	P_2	r_2	I_2	P_3	r_3	I_3
20								2