

Key Light/Fill Light = Use units to understand and solve problems

Program Task: Determine Video Lighting Intensity

Program Associated Vocabulary

LUX, FOOTCANDLE(fc), INTENSITY, KEY LIGHT, FILL LIGHT, BACKLIGHT

Program Formulas and Procedures

A ratio in lighting indicates the relationship between the intensity of the key light to the intensity of the fill light. This is important in contrast lighting in photography. This is an example of a 2:1 ratio.

$$\frac{2}{1} = \frac{\text{Key light}}{\text{Fill light}}$$

Example:

Given a ratio of 3:1, with a key light of 300 fc, what would your fill light be?

Steps

- Identify the proportional relationship and label the units:
Key Light = 300 fc
Fill Light = x fc
Ratio is 3:1
- Set up the proportional relationship, using a variable for the missing value.

$$\frac{3 \text{ fc key light}}{1 \text{ fc fill light}} = \frac{300 \text{ fc key light}}{x \text{ fc fill lights}}$$

- Cross multiply.
 $(3)(x) = (300)(1)$
- Divide by the coefficient.

$$\frac{300}{3} = 100$$

The fill light should be 100 foot-candles.

PA Core Standard: CC.2.1.HS.F.4

Description: Use units as a way to understand problems and to guide the solution of multi-step problems.

Math Associated Vocabulary

RATIO, PROPORTION, CROSS MULTIPLY, SCALE, COEFFICIENT

Formulas and Procedures

A proportion states that two ratios are equal.

$$\frac{a}{b} = \frac{c}{d}$$

Example:

Blue fish outnumber red fish 5 to 3. If there were 21 red fish in the tank, how many blue fish would one expect to find?

Steps

- Identify the proportional relationship and label the units:
5 blue fish to 3 red fish: $\frac{5_{blue}}{3_{red}}$
- Set up the proportional relationship, using a variable for the missing value.
 $\frac{5_{blue}}{3_{red}} = \frac{x_{blue}}{21_{red}}$
- Cross multiply.
 $(5)(21) = 3x \rightarrow 105 = 3x$
- Divide by the coefficient.
 $\frac{105}{3} = x \rightarrow 35 = x$
One would expect to find 35 blue fish.

Teacher's Script - Comparing and Contrasting

This is a great example of where the ratio changes as the situation changes. The formula is not always the same. In many math formulas, an instructor may use the same formula or you may have a situation like the one in this Communication Media example where the formula is not always the same.

Common Mistakes Made By Students

Students do not write each ratio consistently. For example, students may write hours/minutes = minutes/hours.

Conversions of units: In many cases, the student must convert between units before setting up the proportion. For example, if one ratio is money per hour and the student must use that ratio to set up a proportion to solve for money in a given number of days, the student must convert the number of days to hours before proceeding.

Lab Teacher's Extended Discussion

The ratio changes based on the desired mood, which is created by the lighting. A higher the ratio, for example 4:1 or 8:1, will create more of a modeled/dramatic look of the lighting. A 1:1 or 2:1 ratio is considered flat lighting and generally used for video and TV production.

The **key light** is the main light source in a lighting design. The *key light*, as the name suggests, shines directly upon the subject and serves as its principal illuminator; more than anything else, the strength, color and angle of the key determines the shot's overall lighting design.

The **fill light** is placed opposite the key and fills in shadows. The *fill light* also shines on the subject, but it comes from a side angle. It balances the main (key) light by illuminating shaded surfaces.

The **backlight** illuminated the back of the subject and separates it from the background. The *back light* shines on the subject from behind. It separates the subject from the background and highlighting contours.

In order to achieve the results the artist wants, it's important to understand the way these two lights interact with each other. Using ratios, we can let the photographer know what proportion of light comes from each source. This is important to know in different situations so a photo shoot does not have to be re-done because the lighting did not work. Many photographers have set ratios that they can use based on the different locations and lighting requirements necessary to gain a desired effect.

Communication Media Technology (10.9999) T-Chart

| Problems | Occupational (Contextual) Math Concepts | Solutions |
|---|--|------------------|
| 1. Using the ratio of 2:1, what would the fill light be if the key light was 200 fc? | | |
| 2. Given a ratio of 4:1, and a fill light of 50fc, what would your key light be? | | |
| 3. If a backlight is two-thirds of the intensity of the key light, and the key light is 200fc, what is the backlight intensity? | | |
| Problems | Related, Generic Math Concepts | Solutions |
| 4. 1 oil change takes $\frac{1}{4}$ hr. How many changes can be done in an hour? | | |
| 5. Luke can print 5 posters in 15 minutes. How many can he print in one hour? | | |
| 6. Mark works 35 hours and makes \$420.00. How much does he make if he works 25 hours at the same rate? | | |
| Problems | PA Core Math Look | Solutions |
| 7. Vincent buys 4 burgers for \$ 20.00. What is the cost of 10 burgers? | | |
| 8. There are 27 pairs of shoes in a case. How many pairs are there in 12 cases? | | |
| 9. Margie can make buy 7 shirts for \$ 94.50. What would it cost if she only bought 4? | | |

| Problems | Occupational (Contextual) Math Concepts | Solutions |
|---|--|--|
| 1. Using the ratio of 2:1, what would the fill light be if the key light was 200 fc? | $\frac{2 \text{ fc key light}}{1 \text{ fc fill light}}$ | $= \frac{200 \text{ fc key light}}{x \text{ fc fill light}}$ Cross multiply: $2x=200(1)$ Divide: $200/2x$ Solution: $x = 100$ foot-candles |
| 2. Given a ratio of 4:1, and a fill light of 50fc, what would your key light be? | $\frac{4 \text{ fc key light}}{1 \text{ fc fill light}}$ | $= \frac{x \text{ fc key light}}{50 \text{ fc fill light}}$ Cross Multiply: $1x = 200$ Solution $x = 2000$ foot-candles |
| 3. If a backlight is two-thirds of the intensity of the key light, and the key light is 200fc, what is the backlight intensity? | Write the problem: $\frac{2}{3}$ (of) key light= backlight $\frac{2}{3} \times 200 \text{ fc} = \frac{2 \times 200}{3} = 400/3 \approx 133.33$ foot-candles backlight | |
| Problems | Related, Generic Math Concepts | Solutions |
| 4. 1 oil change takes $\frac{1}{4}$ hr. How many changes can be done in an hour? | $\frac{1/4 \text{ hour}}{1 \text{ oil change}}$ | $= \frac{1 \text{ hour}}{x \text{ oil changes}} \rightarrow \frac{1}{4}x = 1$ $(4)\frac{1}{4}x = 1(4) \rightarrow x = 4$ |
| 5. Luke can print 5 posters in 15 minutes. How many can print in one hour? | $\frac{5 \text{ posters}}{15 \text{ minutes}}$ | $= \frac{x \text{ posters}}{60 \text{ minutes}} \rightarrow 15x = 5(60) \rightarrow 15x = 300$ $\frac{15x}{15} = \frac{300}{15} \rightarrow x = 20$ posters |
| 6. Mark works 35 hours and makes \$420.00. How much does he make if he works 25 hours at the same rate? | $\frac{35 \text{ hours}}{\$420}$ | $= \frac{25 \text{ hours}}{x} \rightarrow 35x = 420(25) \rightarrow 35x = 10,500$ $\frac{35x}{35} = \frac{10,500}{35} \rightarrow x = \300.00 |
| Problems | PA Core Math Look | Solutions |
| 7. Vincent buys 4 burgers for \$ 20.00. What is the cost of 10 burgers? | $\frac{4 \text{ burgers}}{\$20}$ | $= \frac{10 \text{ burgers}}{x} \rightarrow 4x = 20(10) \rightarrow 4x = 200$ $\frac{4x}{4} = \frac{200}{4} \rightarrow x = \50 |
| 8. There are 27 pairs of shoes in a case. How many pairs are there in 12 cases? | $\frac{27 \text{ pairs}}{1 \text{ case}}$ | $= \frac{x \text{ pairs}}{12 \text{ cases}} \rightarrow 1x = 27(12) \rightarrow x = 324$ pairs |
| 9. Margie can make buy 7 shirts for \$ 94.50. What would it cost if she only bought 4? | $\frac{7 \text{ shirts}}{\$94.50}$ | $= \frac{4 \text{ shirts}}{x} \rightarrow 7x = 4(94.50) \rightarrow 7x = 378$ $\frac{7x}{7} = \frac{378}{7} \rightarrow x = \54 |