**Foundations of Technology 9th Grade**

**NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**DATE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**UNIT 3: ENGINEERING DESIGN PPT**

What is “Engineering”? “Engineering , the systematic application of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_principals, that produces tangible end \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_that meet our \_\_\_\_\_\_\_\_\_\_\_and desires.”

What is the difference between and “**E**ngineer” and a “**e**ngineer”

“**E**ngineer” - Many years of formal post secondary education and is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a particular \_\_\_\_\_\_\_\_\_\_\_\_\_.

“**e**ngineer” - No formal engineering education but still is \_\_\_\_\_\_\_\_\_\_\_ of producing \_\_\_\_\_\_\_\_\_ to meet needs and \_\_\_\_\_\_\_\_\_\_\_.

**With a partner answer the following questions concerning the ROMAN AQUEDUCTS**

What are some needs or desires that led to these projects?

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What resources were used to create this engineering accomplishment?

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What personal characteristics did the people who planned and built this project?

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Can you get the spring water to the Roman city by only using the aqueduct structures only once? Put the following engineered structures in order to transport the spring water to the city:

**Trench Pressurized Pipe Tunnel Wall Arcade**



 **Facts about Engineering**

* engineers are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solvers
* engineering has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as civilization has\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, with each generation building on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of its predecessors

**7 Resources to used to Create Technology**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4 Personal Characteristics Involved with Engineering**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DESCRIPTION\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Facts: The Engineering Design Process**

* Design problems are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ presented in a \_\_\_\_\_\_\_\_\_\_\_\_\_ defined form.

In your opinion, why are design problems usually not clearly identified?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Have you ever experienced this for a school project or a project that you worked on for someone?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**8 Constraints of the Engineering Design Process**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Obsolescence**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **-** when an object, service or practice is no longer \_\_\_\_\_\_\_\_\_\_\_ even though it may still be in \_\_\_\_\_\_\_\_\_\_ working order

**Types:**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Obsolescence - a \_\_\_\_\_\_\_\_\_\_ product or technology is better than the \_\_\_\_\_\_\_, and it is

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over the old

Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Obsolescence – when a product does not \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as it did when it was

\_\_\_\_\_\_\_\_\_a.k.a. worn out or broken

Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Obsolescence – the planned or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ wearing down or \_\_\_\_\_\_\_\_\_\_\_ of a

product so a new purchase will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Obsolescence – when a product is no longer \_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it has gone out of the

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fashion, its style is \_\_\_\_\_\_\_\_\_\_\_\_\_. Sometimes it becomes

popular again many \_\_\_\_\_\_\_\_\_\_\_\_ later.

Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Obsolescence – technological \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are not introduced to a

\_\_\_\_\_\_\_\_\_\_, even though they \_\_\_\_\_\_\_\_\_\_ be

Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Do you agree with the video? Explain your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is ***sustainability***? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **-** the \_\_\_\_\_\_\_\_\_\_ of designing jobs, equipment, and workplaces to \_\_\_\_\_\_\_\_\_\_ workers. Proper ergonomic design is necessary to prevent \_\_\_\_\_\_\_\_\_\_\_\_\_\_ strain injuries which can develop over time and can lead to long-term \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

* List 5 products that have changed over time to become more ergonomic and tell how they have changed.
1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**6 Established Design Principals to Evaluate Designs**

 1. Design is the result of a \_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_process.

2. Design problems seldom arise in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ defined form.

3. Design is driven by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ motive and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

4. Design \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sometimes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with each other.

5. Design is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_-oriented research.

6. Designs must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_ checked, refined, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Bean Counters: Crunching the Numbers**

In designing a device or \_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ should be given to how it will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, operated, maintained, \_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_ of and who will sell, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and take care of it.

**MATHMETICAL MODELING**

The basic idea of ***mathematical*** *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*is to find a mathematical \_\_\_\_\_\_\_\_\_\_\_\_\_\_ that behaves in the same ways as the \_\_\_\_\_\_\_\_\_\_\_\_\_ or processes under \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

This gives \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a way to study and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the behavior of materials or new \_\_\_\_\_\_\_\_\_\_\_\_\_\_ before they are manufactured.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ have greatly improved the power and use of mathematical models by performing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that are very long, very \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or repetitive.

What is one example that was used in the video? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Bean Counters: Crunching the Numbers What Engineers Do:**

* Use the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of mathematics to express mathematical ideas \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Analyze and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the mathematical thinking and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of others.
* Create and use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to organize, record, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mathematical ideas.
* Select, apply, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ among mathematical representations to \_\_\_\_\_\_\_\_ problems.
* Use representations to \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ physical, social, and mathematical phenomena.