

This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found [here](#).

If you have a suggestion to make the keys better, please fill out the short survey [here](#).

*Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.*

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1. Solve the modeling problem below, if possible.

*In CHM2045L, Brittany created a 16 liter 20 percent solution of chemical  $\chi$  using two different solution percentages of chemical  $\chi$ . When she went to write her lab report, she realized she forgot to write the amount of each solution she used! If she remembers she used 19 percent and 43 percent solutions, what was the amount she used of the 43 percent solution?*

The solution is 0.67, which is option A.

A. 0.67

\*This is the correct option.

B. 5.90

This was a random value. If this was not a guess, contact the coordinator to talk about how you got this value.

C. 8.00

This would be correct if Brittany used equal parts of each solution.

D. 15.33

This is the concentration of 19 percent solution.

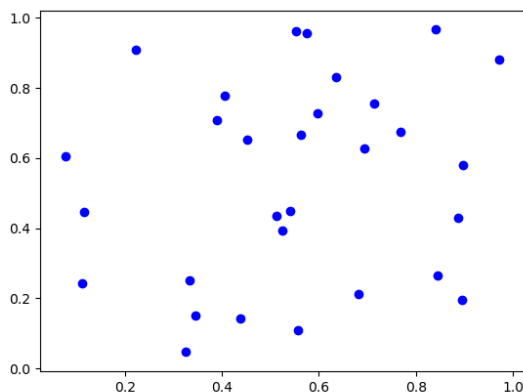
E. There is not enough information to solve the problem.

You may have chose this if you thought you needed to know how much of the second solution was used in the problem. Remember that the total minus the first solution would give you the second amount used.

**General Comment:** Build the model exactly as you did in Module 9M. Then, solve for the volume you are looking for.

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2. Determine the appropriate model for the graph of points below.



The solution is None of the above, which is option E.

A. Linear model

For this to be the correct option, we need to see a mostly straight line of points.

B. Logarithmic model

For this to be the correct option, we want a rapid change early, then an extremely slow change later.

C. Exponential model

For this to be the correct option, we want an extremely slow change early, then a rapid change later.

D. Non-linear Power model

For this to be the correct option, we need to see a polynomial or rational shape.

E. None of the above

For this to be the correct option, we want to see no pattern in the points.

**General Comment:** This question is testing if you can associate the models with their graphical representation. If you are having trouble, go back to the corresponding Core module to learn about the specific function you are having trouble recognizing.

3. For the information below, construct a linear model that describes the total time  $T$  spent on the path in terms of the distance of a particular part of the path *if we know that the time spent on each path was equal.*

*A bicyclist is training for a race on a hilly path. Their bike keeps track of their speed at any time, but not the distance traveled. Their speed traveling up a hill is 2 mph, 7 mph when traveling down a hill, and 5 mph when traveling along a flat portion.*

The solution is The model can be found with the information provided, but isn't options 1-3., which is option D.

A.  $14.000D$

The coefficient here is calculated as if you were trying to model the distance on the total path.

B.  $0.843D$

This would be correct if we knew all parts of the path are equal length.

C.  $70.000D$

The coefficient here is calculated by multiplying the distances together rather than adding.

D. The model can be found with the information provided, but isn't options 1-3.

\* This is the correct option. Since the time spent on each path was equal, the distance of each path must be different. The model would be  $0.500D_u + 0.143D_d + 0.200D_f$ , where  $D_u$  is distance traveling up the hill,  $D_d$  is distance traveling down, and  $D_f$  is distance traveling on a flat part.

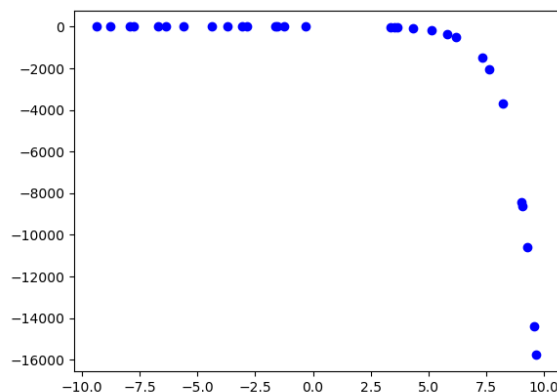
E. The model cannot be found with the information provided.

If you chose this option, please contact the coordinator to discuss why you think we cannot model the situation.

**General Comment:** Be sure you pay attention to the variable we are writing the model in terms of. To create the model with a single variable, we have to know that variable is the same throughout each path!

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4. Determine the appropriate model for the graph of points below.



The solution is Exponential model, which is option A.

A. Exponential model

For this to be the correct option, we want an extremely slow change early, then a rapid change later.

B. Logarithmic model

For this to be the correct option, we want a rapid change early, then an extremely slow change later.

C. Linear model

For this to be the correct option, we need to see a mostly straight line of points.

D. Non-linear Power model

For this to be the correct option, we need to see a polynomial or rational shape.

E. None of the above

For this to be the correct option, we want to see no pattern in the points.

**General Comment:** This question is testing if you can associate the models with their graphical representation. If you are having trouble, go back to the corresponding Core module to learn about the specific function you are having trouble recognizing.

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5. For the scenario below, model the rate of vibration (cm/s) of the string in terms of the length of the string. Then determine the variation constant  $k$  of the model (if possible). The constant should be in terms of cm and s.

*The rate of vibration of a string under constant tension varies based on the type of string and the length of the string. The rate of vibration of string  $\omega$  increases as the square length of the string decreases. For example, when string  $\omega$  is 5 mm long, the rate of vibration is 40 cm/s.*

The solution is  $k = 10.00$ , which is option B.

- A.  $k = 160.00$

This option uses the model  $R = kl^2$  as if this is a direct variation.

- B.  $k = 10.00$

\* This is the correct option, which corresponds to the model  $R = \frac{k}{l^2}$  AND converts from mm to cm.

- C.  $k = 1000.00$

This option uses the correct model,  $R = \frac{k}{l^2}$ , but does not convert from mm to cm so that the units match.

- D.  $k = 1.60$

This option uses the model  $R = kl^2$  as if this is a direct variation AND does not convert from mm to cm so that the units match.

- E. None of the above.

Talk with the coordinator if you chose this option.

**General Comment:** The most common mistake on this question is to not convert mm to cm! When modeling, you need to make sure all of the units for your variables are compatible.

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6. For the scenario below, use the model for the volume of a cylinder as  $V = \pi r^2 h$ .

*Pringles wants to add 22 percent more chips to their cylinder cans and minimize the design change of their cans. They've decided that the best way to minimize the design change is to increase the radius and height by the same percentage. What should this increase be?*

The solution is About 7 percent, which is option A.

- A. About 7 percent

\* This is the correct option.

- B. About 3 percent

This corresponds to not solving for the increase properly.

- C. About 10 percent

This corresponds to solving correctly but treating both radius and height as equal contributors to the volume.

D. About 11 percent

This corresponds to treating both radius and height as equal contributors and not solving correctly.

E. None of the above

If you chose this, please contact the coordinator to discuss how you solved the problem.

**General Comment:** Remember that when plugging the increases of values in, you need to treat it as that percentage above 100. For example, a 5 percent increase means 105 percent.

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7. Solve the modeling problem below, if possible.

*A new virus is spreading throughout the world. There were initially 6 many cases reported, but the number of confirmed cases has tripled every 4 days. How long will it be until there are at least 10000 confirmed cases?*

The solution is About 28 days, which is option B.

A. About 30 days

You modeled the situation with  $e$  as the base, but solved correctly otherwise.

B. About 28 days

\* This is the correct option.

C. About 13 days

You modeled the situation correctly but did not apply the properties of log correctly.

D. About 14 days

You modeled the situation with  $e$  as the base and did not apply the properties of log correctly.

E. There is not enough information to solve the problem.

If you chose this option, please contact the coordinator to discuss why you think this is the case.

**General Comment:** Set up the model the same as in Module 11M. Then, plug in 10000 and solve for  $d$  in your model.

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8. Solve the modeling problem below, if possible.

*A new virus is spreading throughout the world. There were initially 4 many cases reported, but the number of confirmed cases has doubled every 5 days. How long will it be until there are at least 1000000 confirmed cases?*

The solution is About 90 days, which is option B.

A. About 63 days

You modeled the situation with  $e$  as the base, but solved correctly otherwise.

B. About 90 days

\* This is the correct option.

C. About 34 days

You modeled the situation correctly but did not apply the properties of log correctly.

D. About 29 days

You modeled the situation with  $e$  as the base and did not apply the properties of log correctly.

E. There is not enough information to solve the problem.

If you chose this option, please contact the coordinator to discuss why you think this is the case.

**General Comment:** Set up the model the same as in Module 11M. Then, plug in 1000000 and solve for  $d$  in your model.

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9. For the scenario below, use the model for the volume of a cylinder as  $V = \pi r^2 h$ .

*Pringles wants to add 44 percent more chips to their cylinder cans and minimize the design change of their cans. They've decided that the best way to minimize the design change is to increase the radius and height by the same percentage. What should this increase be?*

The solution is About 13 percent, which is option C.

A. About 22 percent

This corresponds to treating both radius and height as equal contributors and not solving correctly.

B. About 20 percent

This corresponds to solving correctly but treating both radius and height as equal contributors to the volume.

C. About 13 percent

\* This is the correct option.

D. About 4 percent

This corresponds to not solving for the increase properly.

E. None of the above

If you chose this, please contact the coordinator to discuss how you solved the problem.

**General Comment:** Remember that when plugging the increases of values in, you need to treat it as that percentage above 100. For example, a 5 percent increase means 105 percent.

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10. Solve the modeling problem below, if possible.

*In CHM2045L, Brittany created a 26 liter 14 percent solution of chemical  $\chi$  using two different solution percentages of chemical  $\chi$ . When she went to write her lab report, she realized she forgot to write the amount of each solution she used! If she remembers she used 9 percent and 32 percent solutions, what was the amount she used of the 32 percent solution?*

The solution is 5.65, which is option C.

A. 20.35

This is the concentration of 9 percent solution.

B. 13.96

This was a random value. If this was not a guess, contact the coordinator to talk about how you got this value.

C. 5.65

\*This is the correct option.

D. 13.00

This would be correct if Brittany used equal parts of each solution.

E. There is not enough information to solve the problem.

You may have chose this if you thought you needed to know how much of the second solution was used in the problem. Remember that the total minus the first solution would give you the second amount used.

**General Comment:** Build the model exactly as you did in Module 9M. Then, solve for the volume you are looking for.

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