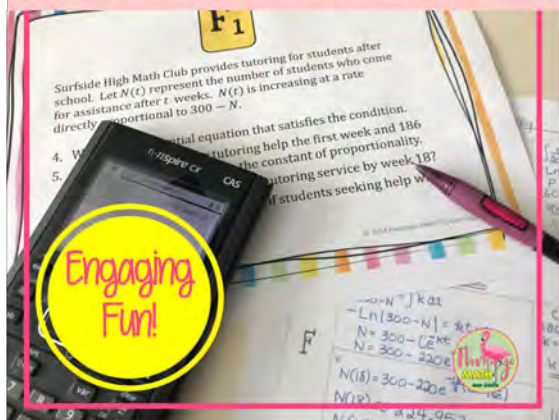


Differential Equations Task Card Stations



Differential Equations Stations Task Cards Activity

Your AP Calculus students will have 11 task cards related to your unit on Differential Equations to provide engaging fun as a unit review.

This set of task cards is for use as a cooperative learning activity. They can be used as a station rotation or printed in reduced form as a math workshop station for general review.

Differential Equations Stations Activity

Use this activity as an end-unit review for **Differential Equations**. The concepts will help your students work through the rules for differential equations including

- ☐ separation of variables
- ☐ growth and decay
- ☐ logistics problems related to population
- ☐ half-life and exponential growth
- ☐ Newton's Cooling Law
- ☐ investments and more

There are 11 question stems in the activity. You can use the set as a group rotation activity for 2-4 per group or as a review activity prior to assessing students on the unit.

College Board® Topics:

Topic 7.1: Modeling Situations with Differential Equations

Topic 7.2: Verifying Solutions for Differential Equations

Topic 7.6: Finding General Solutions Using Separation of Variables

Topic 7.7: Finding Particular Solutions Using Initial Conditions and Separation of Variables

Topic 7.8: Exponential Models with Differential Equations

You may be interested in purchasing the [Slope Field Match Activity](#).



D

1. The rate of change of N is proportional to N . When $t = 0$, $N = 240$, and when $t = 1$, $N = 380$. What is the value of N when $t = 4$?
2. If $\frac{dP}{dt} = 0.06(200 - P)$ and $P = 60$ when $t = 0$, find P when $t = 3$.

I₁

3. Find the population of a town that is growing at a rate of 2% per year. If the population was 100,000 in 1950, what will it be in 2050?

E

8. Cobalt-60 has a half-life of 5.26 years. This radioisotope is used to sterilize surgical instruments and to improve the safety and reliability of industrial fuel oil burners. Cobalt-60 is also used in cancer treatment, food irradiation, gauges and radiography. If the decay is modeled by the differential equation $\frac{dy}{dt} = -ky$ where t is measured in years, what is the decay constant k ?

Q

9. The radioactive decay of Iodine-131 can be modeled by the differential equation $\frac{dy}{dt} = -0.0859y$ where t is measured in days. Find the half-life of Iodine-131.

U

The number of bacteria in a culture increases from 1200 to 1500 in 6 hours. Assume the growth is proportional to the number of bacteria present.

11. How many bacteria are there at a certain time? The culture starts with 1,000,000 bacteria.

T

Newton's Cooling Law tells us that the rate of cooling for an object is directly proportional to the temperature difference between the object and the surrounding air temperature. Suppose a large fresh ham is taken from the oven at 145° and placed on a rack to cool where the temperature is 82° . If H is the temperature of the ham after t minutes, then Newton's Law implies $\frac{dH}{dt} = k(H - 82)$.

16. Solve the differential equation for H . Find C , then find the particular solution.
17. If the ham temperature is 140° after 20 minutes, what is the temperature after half an hour?
18. When will the temperature reach 120° ?



Strontium-90 has been shown to cause cancer in humans. This radioactive isotope has a half-life of 28.6 years and was released into the Pacific Ocean during the Fukushima power plant disaster following the 3/11/14 tsunami in Japan. Initial reports showed 480 Bq/L present in the water around reactor 1 and 2. On 5/15/2014 new measurements showed up to 1400 Bq/L present in the surrounding waters. [Source: Energy News.com]

19. How long will it take for the Strontium-90 in the water returns to previous level?

The population of Flatland is 120,000. The community...

Write a differential equation to express population as a function of time.

Solve the differential equation to express population as a function of time.

20. What is the expected population for Flatland in 5 years?

0

The acceleration of a particle moving along a straight line is given by $a(t) = 8e^{2t}$

20. Find the velocity of the particle as a function of time, t , if $v(0) = 0$

Find the interval where the particle is moving to the right.

Find the position of the particle at $t = 1$.

Differentiate

NAME: _____

1.	2.
3.	4.
5.	6.
7.	8.
9.	10.
11.	12.
13.	14.
15.	16.
17.	18.
19.	20.

10

B

1. The rate of change of N is proportional to N . $N = 240$, and when $t = 1$, $N = 380$. What is N when $t = 4$?
2. If $\frac{dp}{dt} = 0.06(200 - P)$ and $P = 60$ when $t = 0$, $t = 3$.

I₁

3. Find the principal that should be invested at a rate of compounded monthly, so that 2 million dollars will be available for retirement in 40 years. Round your answer to the nearest cent.

F₁

Surfside High Math Club provides tutoring for school. Let $N(t)$ represent the number of students for assistance after t weeks. $N(t)$ is increasing directly proportional to $300 - N$.

4. Write the differential equation that satisfies the situation.
5. If 80 students come for tutoring help the first week, find k , the constant of proportionality.
6. How many students will use the tutoring service after 10 weeks?
7. What is the limit to the number of students?

E

Half-60 has a half-life of 5.26 years. It is used to sterilize surgical instruments, in the production of industrial fuel oil, in cancer treatment, food irradiation, and in hydroponics. If the decay model is $\frac{dA}{dt} = -kA$, what is the value of k ?

Radioisotope is used to prove the safety of nuclear power. Half-60 is also used in the production of nuclear energy. What is the half-life of Half-60?

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Q

9. The radioactive decay of a substance is modeled by the differential equation $\frac{dy}{dt} = -ky$. Find the half-life of the substance.

U

The number of bacteria in a culture grows from 12 to 32,000 in 6 hours. Assume the growth is proportional to the number of bacteria.

10. Find the number of bacteria after 2 hours.
11. Find the number of bacteria after 12 hours.

A

A cylindrical container is partially filled with liquid. The height of the liquid is h and the radius is r . The volume of the liquid is V . Find the relationship between h and r .

T

Newton's Law tells us that the rate of cooling for an object is proportional to the temperature difference between the object and the surrounding air. Suppose a large fresh ham is taken from the oven at 145° and placed on a rack to cool. If H is the temperature of the ham in degrees Fahrenheit, then Newton's Law implies $\frac{dH}{dt} = k(H - 82)$.

Find the particular solution for H . Find C , then find the particular solution.

17. If the ham temperature is 140° after 20 minutes, what is the temperature after half an hour?

I₂

Strontium-90 is a radioactive isotope that is known to cause cancer in humans. This isotope has a half-life of 28.6 years and was released into the environment during the Fukushima power plant disaster following the 2011 tsunami in Japan. Initial reports showed 480 Bq/L of Strontium-90 in the water around reactor 1 and 2. On 5/15/2014 new measurements showed up to 1400 Bq/L present in the surrounding waters. [Source: Energy News.com]

19. How long will it take for the Strontium-90 to decay so the water returns to previous levels of contamination?

G

The acceleration of a particle moving along a straight line is given by $a(t) = 8e^{2t}$.

20. Find the velocity function in terms of time, t , if $v = 4$ when $t = 0$.
21. During the time interval where velocity increases from 4 to 20, how far does the particle travel?
22. Find the position function for the particle?

N

The population of Flatland is 1200 people. The community is growing at a rate of 5% per year.

23. Write a differential equation that models the population of Flatland.
24. Solve the differential equation to express population as a function of time.
25. What is the expected population for Flatland in 5 years?

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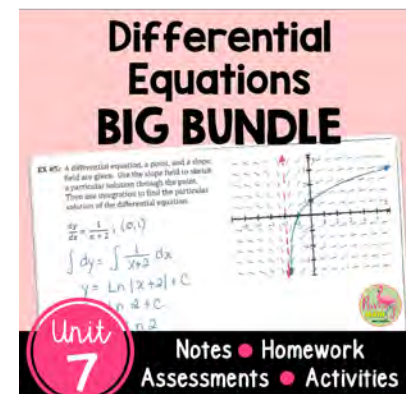
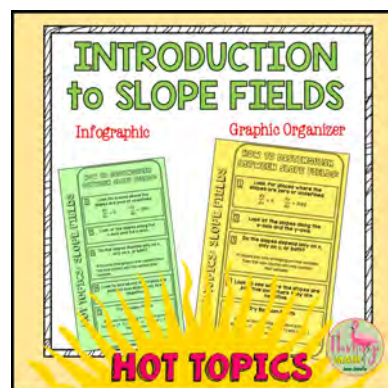
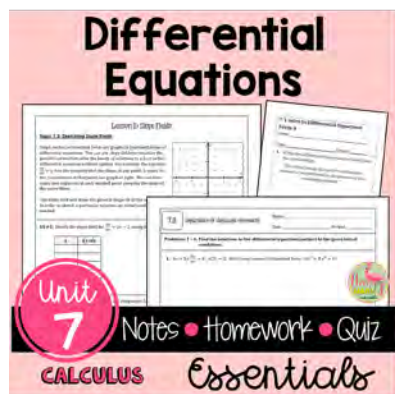
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