Performance Task

Performance Task: Exponential Functions
Chapter 7

Exponential equations are often used in financial planning. Car loans, mortgages, students and investments can be calculated using a compound interest formula.

The Brandt's are a young couple just getting started in planning their financial future. They have decided to take two steps towards their goal.

Goal 1: Saving Money for the Future.

The Brandt's have $1000 to invest in a compound interest investment. They found a fund that promises them 12.5% per annum for the duration of their investment.

   a. Investments can often be represented in the form $y = ab^x$. State the b value of the investment above. State (and use) this **b value as a fraction for the remainder of this assignment.** (1 mark)

   ○ $b = 1.125$

   ○ $b = \left(\dfrac{9}{8}\right)$

   *Use as a fraction.

   b. Determine the equation in the form $P(x) = ab^x$, where x is the time in years. State the transformation required from the basic exponential function in the form $y = b^x$. (2 marks)

   ○ $P(x) = 1000\left(\dfrac{9}{8}\right)^x$

   ○ Vertical stretch by a factor of 1000 about xaxis

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Goal 2: Buying a Car

The Brandt's also need a reliable vehicle; the loan officer has given them the formula $C(x) = 19000\left(\frac{8}{9}\right)^x$ where x is the time in years, to define the term of their loan.

a. How much is the purchase price of the Brandt's vehicle? (1 mark)

$19000.

b. What is the annual rate of depreciation? (1 mark)

$b = (0.89)$

∴ rate of depreciation $= 11\%$.

c. **How** would the equation given by the loan officer change if the Brandt's decide to take a car dealership offer that states they "don't have to pay for one full year"? **Call the function Q(x) and state it below.** (2 marks)

"Write a replacement rule

$C(x) = 19000\left(\frac{8}{9}\right)^{x-1}$

+more one unit to the right b/c payment # will increase by one.

$\boxed{x \rightarrow x-1}$

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Graph *P(x)* and *C(x)* on the grid below.   Use the following window settings to define your graph [-10, 30, 1, -10, 25000, 1000]. (3 marks)
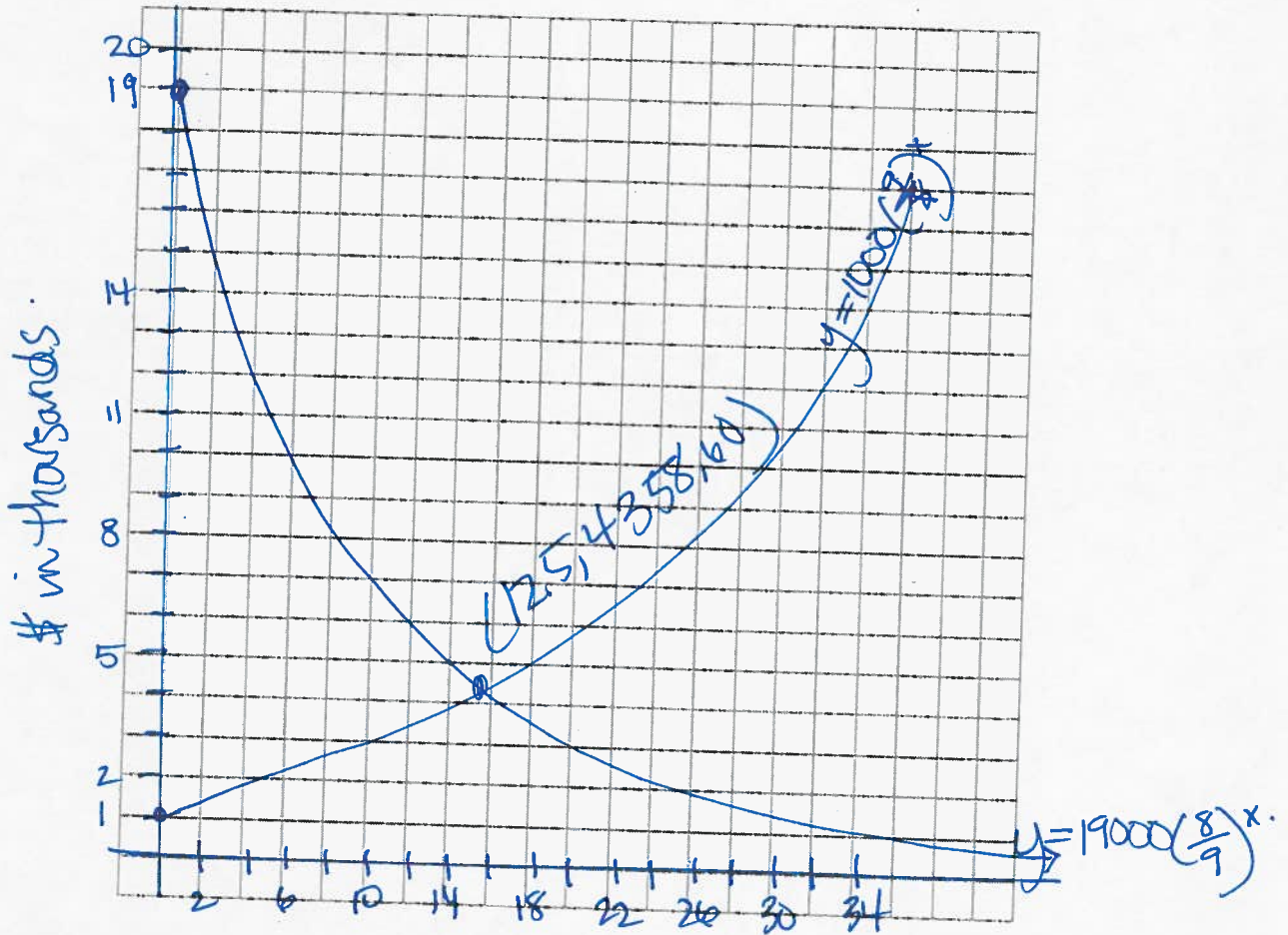
State the Domain and Range of *P(x)* and *C(x)*. Be sure to take the context of the situation under consideration. (1 mark)

	Domain	Range
P(x)	$x \in \mathbb{R}$ $x \geq 0$	$y \geq 0$
C(x)	$x \geq 0, x \in \mathbb{R}$	$y > 0$.

☆ time has to be greater than 0.
therefore limited $x \in \mathbb{R}$.

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Goal 3: Long Term Future

The Brandt's are wondering what the long term effects of their goals will be.

a. Using the graph above, determine the point in which the Brandt's break even. Label the point on the graph above. Communicate in the space below the process of obtaining this solution. (2 marks)

$(12.5, 4358.60)$

$Y_1 = 19000\left(\frac{8}{9}\right)^x$

$Y_2 = 1000\left(\frac{9}{8}\right)^x$

Find the intersect point
2nd F TRACE.

b. What is the Brandt's monetary balance at this point? How many years did it take for them to get here? (2 marks)

It took the 12.5 yrs to get to
a monetary balance of
they will have $4358.60.

c. **Prove** the solution you determined above **algebraically**. (4 marks)

$$\frac{19000\left(\frac{8}{9}\right)^x}{1000} = \frac{1000\left(\frac{9}{8}\right)^x}{1000}$$

$$\frac{19\left(\frac{9}{8}\right)^{-x}}{\left(\frac{9}{8}\right)^{-x}} = \frac{\left(\frac{9}{8}\right)^x}{\left(\frac{9}{8}\right)^{-x}}$$

$$19 = \left(\frac{9}{8}\right)^{2x}$$

$$\left(\frac{9}{8}\right)^{25} = \left(\frac{9}{8}\right)^{2x}$$

$$25 = 2x$$

$$\boxed{12.5 = x}$$