ALGEBRA 2
Workbook
Common Core Standards
Edition

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Common Core High School Math Reference Sheet
(Algebra I, Geometry, Algebra II)

CONVERSIONS

1 inch = 2.54 centimeters	1 kilometer = 0.62 mile	1 cup = 8 fluid ounces
1 meter = 39.37 inches	1 pound = 16 ounces	1 pint = 2 cups
1 mile = 5280 feet	1 pound = 0.454 kilograms	1 quart = 2 pints
1 mile = 1760 yards	1 kilogram = 2.2 pounds	1 gallon = 4 quarts
1 mile = 1.609 kilometers	1 ton = 2000 pounds	1 gallon = 3.785 liters
		1 liter = 0.264 gallon
		1 liter = 1000 cubic centimeters

FORMULAS

Triangle	$A = \dfrac{1}{2}bh$	Pythagorean Theorem	$a^2 + b^2 = c^2$
Parallelogram	$A = bh$	Quadratic Formula	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Circle	$A = \pi r^2$	Arithmetic Sequence	$a_n = a_1 + (n-1)d$
Circle	$C = \pi d$ or $C = 2\pi r$	Geometric Sequence	$a_n = a_1 r^{n-1}$
General Prisms	$V = Bh$	Geometric Series	$S_n = \dfrac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$
Cylinder	$V = \pi r^2 h$	Radians	$1 \text{ radian} = \dfrac{180}{\pi} \text{ degrees}$
Sphere	$V = \dfrac{4}{3}\pi r^3$	Degrees	$1 \text{ degree} = \dfrac{\pi}{180} \text{ radians}$
Cone	$V = \dfrac{1}{3}\pi r^2 h$	Exponential Growth/Decay	$A = A_0 e^{k(t - t_0)} + B_0$
Pyramid	$V = \dfrac{1}{3}Bh$		

i

August 2023
Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Record your answers in the space provided. [48]

1. A group of high school students wanted to collect information on how many times per week students exercised. If they want the *least* biased results they should survey every fifth student at the school who is
(1) entering the gym
(2) in the junior class
(3) entering the library
(4) entering the building   1 _____

2. Given $x \neq -3$, which expression is equivalent to $\dfrac{2x^3 + 3x^2 - 4x + 5}{x + 3}$?

(1) $2x^3 + 9x^2 + 23x + 74$

(2) $2x^2 - 3x + 5 - \dfrac{10}{x + 3}$

(3) $2x^3 - 3x^2 + 5x - 10$

(4) $2x^2 + 9x + 23 + \dfrac{74}{x + 3}$ 2 _____

3. The table shows the food preferences of sports fans whose favorite sport is football or baseball.

Favorite Food to Eat While Watching Sports

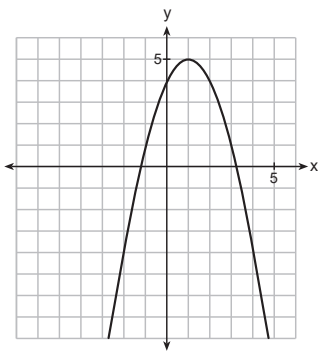|	Wings	Pizza	Hot Dogs
Football	14	20	6
Baseball	6	12	42

The probability that a fan prefers pizza given that the fan prefers football is

(1) $\dfrac{1}{2}$ (2) $\dfrac{1}{5}$ (3) $\dfrac{5}{8}$ (4) $\dfrac{13}{25}$ 3 _____

4. If $f(x) = 12x - 4$, then the inverse function $f^{-1}(x)$ is

(1) $f^{-1}(x) = \dfrac{x + 1}{3}$

(2) $f^{-1}(x) = \dfrac{x}{3} + 1$

(3) $f^{-1}(x) = \dfrac{x + 4}{12}$

(4) $f^{-1}(x) = \dfrac{x}{12} + 4$ 4 _____

5. The graph of a quadratic function is shown.

When the graph of $x + y = 4$ is drawn on the same axes, one solution to this system is
(1) (4, 0)   (3) (2, 2)
(2) (1, 5)   (4) (3, 1)

5 _____

August 2023

6. What is the solution of $2(3^{x+4}) = 56$?

(1) $x = \log_3(28) - 4$ (3) $x = \log(25) - 4$

(2) $x = -1$ (4) $x = \dfrac{\log(56)}{\log(6)} - 4$ 6 _____

7. In a survey of people who recently bought a laptop, 45% said they were looking for a large screen, 31% said they were looking for a fast processor, and 58% said they wanted a large screen or a fast processor. If a survey respondent is selected at random, what is the probability that the respondent wanted both a large screen and a fast processor?
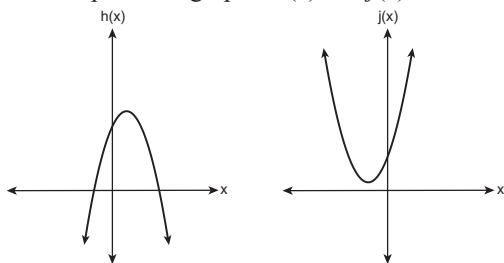
(1) 76%   (2) 14%   (3) 77%   (4) 18%   7 _____

8. In the quadratic formula, $b^2 - 4ac$ is called the discriminant. The function $f(x)$ has a discriminant value of 8, and $g(x)$ has a discriminant value of -16. The quadratic graphs, $h(x)$ and $j(x)$, are shown below.

h(x)   j(x)

Which quadratic functions have imaginary roots?

(1) $g(x)$ and $h(x)$ (3) $f(x)$ and $h(x)$

(2) $g(x)$ and $j(x)$ (4) $f(x)$ and $j(x)$ 8 _____

9. The element Americium has a half-life of 25 minutes. Given an initial amount, A_0, which expression could be used to determine the amount of Americium remaining after t minutes?

(1) $A_0\left(\dfrac{1}{2}\right)^{\frac{t}{25}}$ (2) $A_0(25)^{\frac{t}{2}}$ (3) $25\left(\dfrac{1}{2}\right)^{t}$ (4) $A_0\left(\dfrac{1}{2}\right)^{25t}$ 9 _____

10. Which function has the greatest y-intercept?

(1) $f(x) = 4\sin(2x)$ (3) $h(x) = 5e^{2x} + 3$

(2) $g(x) = 3x^4 + 2x^3 + 7$ (4) $j(x) = 6\log_2(3x + 4)$ 10 _____

11. According to the USGS, an agency within the Department of Interior of the United States, the frog population in the U.S. is decreasing at the rate of 3.79% per year. A student created a model, $P = 12{,}150(0.962)^t$, to estimate the population in a pond after t years. The student then created a model that would predict the population after d decades. This model is best represented by

(1) $P = 12{,}150(0.461)^d$ (3) $P = 12{,}150(0.996)^d$

(2) $P = 12{,}150(0.679)^d$ (4) $P = 12{,}150(0.998)^d$ 11 _____

12. What is the value of $\tan\theta$ when $\sin\theta = \frac{2}{5}$ and θ is in quadrant II?

(1) $\frac{-\sqrt{21}}{5}$ (2) $\frac{-\sqrt{21}}{2}$ (3) $\frac{-2}{\sqrt{21}}$ (4) $\frac{2}{\sqrt{21}}$ 12 ____

13. A population is normally distributed with a mean of 23 and a standard deviation of 1.2. The percentage of the population that falls below 21, to the *nearest hundredth*, is

(1) 0.05   (2) 4.78   (3) 8.29   (4) 91.30   13 ____

14. Audra is interested in studying the number of students entering kindergarten in the Ahlville Central School District over the next several years. Using data dating back to 2015, she determines that the number of kindergarteners is decreasing at an exponential rate. She creates a formula to model this situation $y = a(b)^x$, where x is the number of years since 2015 and y is the number of students entering kindergarten. If there were 105 students entering kindergarten in Ahlville in 2015, which statement about Audra's formula is true?

(1) a is positive and b is negative.   (3) Both a and b are positive.
(2) a is negative and b is positive.   (4) Both a and b are negative.   14 ____

15. The solution set for the equation $\sqrt{3(x+6)} = x$ is

(1) {6, −3}   (2) {−6, 3}   (3) {6}   (4) {−3}   15 ____

16. The George family would like to borrow $45,000 to purchase a new boat. They qualified for a loan with an annual interest rate of 6.75%. The monthly loan payment can be found using the formula below.

$$M = \frac{P\left(\frac{r}{12}\right)\left(1+\frac{r}{12}\right)^n}{\left(1+\frac{r}{12}\right)^n - 1}$$

M = monthly payment
P = amount borrowed
r = annual interest rate
n = number of monthly payments

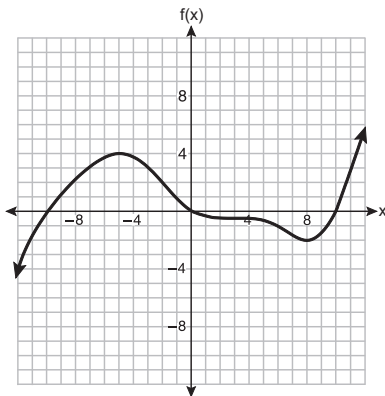What is the monthly payment if they would like to pay off the loan in five years?

(1) $262.99   (2) $252.13   (3) $915.24   (4) $885.76   16 ____

17. A retailer advertises that items will be discounted by 10% every Monday until they are sold. In how many weeks will an item costing $50 first be sold for under half price?

(1) 7   (2) 6   (3) 5   (4) 4   17 ____

18. The graph of the function $f(x)$ is shown.

In which interval is $f(x)$ always positive?
(1) (–2, 4)
(2) (0, 10)
(3) (–12, –5)
(4) (–10, 0)

18 _____

19. If $f(x) = (x^2 + 3x + 2)(x^2 – 4x + 3)$ and $g(x) = x^2 – 9$, then how many real solutions are there to the equation $f(x) = g(x)$?
(1) 1   (2) 2   (3) 6   (4) 4

19 _____

20. Which expression is a factor of $x^4 – x^3 – 11x^2 + 5x + 30$?
(1) $x + 2$ (2) $x – 2$ (3) $x + 5$ (4) $x – 5$

20 _____

21. The expression $\dfrac{x^2 + 6}{x^2 + 4}$ is equivalent to

(1) $\dfrac{6}{4}$ (2) $1 + \dfrac{10}{x^2 + 4}$ (3) $1 - \dfrac{2}{x^2 + 4}$ (4) $1 + \dfrac{2}{x^2 + 4}$

21 _____

22. Stone Manufacturing has developed a cost model, $C(x) = 0.18x^3 + 0.02x^2 + 4x + 180$, where x is the number of sprockets sold, in thousands. The sale price can be modeled by $S(x) = 95.4 – 6x$ and the company's revenue by $R(x) = x \cdot S(x)$.
The company profits, $R(x) – C(x)$, could be modeled by
(1) $0.18x^3 + 6.02x^2 + 91.4x + 180$
(2) $0.18x^3 – 5.98x^2 – 91.4x + 180$
(3) $–0.18x^3 – 6.02x^2 + 91.4x – 180$
(4) $0.18x^3 + 5.98x^2 + 99.4x + 180$

22 _____

23. Which function is even?
(1) $f(x) = x^3 + 2$ (3) $f(x) = |x + 2|$
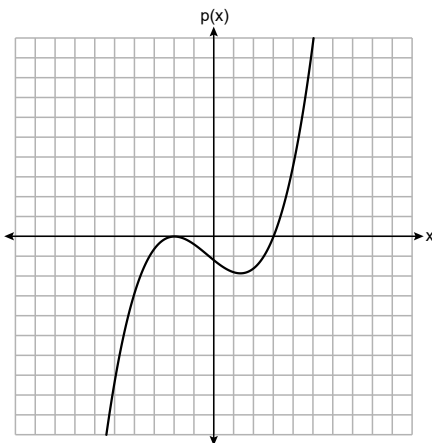(2) $f(x) = x^2 + 1$ (4) $f(x) = \sin(2x)$

23 _____

24. The graph of a cubic polynomial function $p(x)$ is shown.

If $p(x)$ is written as a product of linear factors, which factor would appear twice?

(1) $x - 2$ (3) $x - 3$
(2) $x + 2$ (4) $x + 3$

24 _____

Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

25. Factor the expression $2x^3 - 3x^2 - 18x + 27$ completely.

23. The height of a running trail is modeled by the quartic function $y = f(x)$ shown, where x is the distance in miles from the start of the trail and y is the height in feet relative to sea level.
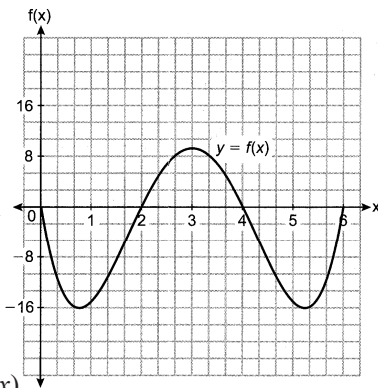
If this trail has a minimum height of 16 feet below sea level, which function(s) could represent a running trail whose minimum height is half of the minimum height of the original trail?

I. $y = f\left(\dfrac{1}{2}x\right)$ II. $y = f(x) + 8$ III. $y = \dfrac{1}{2}f(x)$

(1) I, only   (2) II, only   (3) I and III   (4) II and III   23 ____

24. The crew aboard a small fishing boat caught 350 pounds of fish on Monday. From that Monday through the end of the week on Friday, the weight of the fish caught increased 15% per day. The total weight, in pounds, of fish caught is approximately

(1) 411   (2) 612   (3) 1748   (4) 2360   24 ____

Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. **[16]**

25. Describe the translations that map $f(x) = \log x$ to $g(x) = \log(x + 3) - 5$.

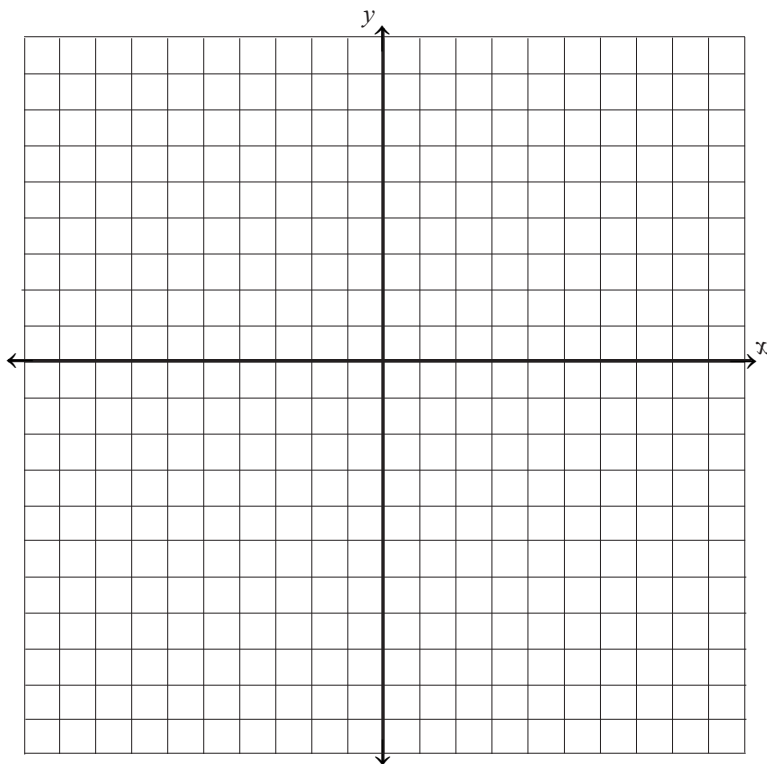26. Solve algebraically for x: $\dfrac{1}{2x} - \dfrac{5}{6} = \dfrac{3}{x}$

27. Given $\cos\theta = -\dfrac{2}{7}$ with θ in Quadrant II, find the exact value of $\sin\theta$.

28. Given $a > 1$, use the properties of rational exponents to determine the value of x for the equation below.

$$\dfrac{\sqrt[5]{a^{10}}}{\left(a^3\right)^{\frac{1}{2}}} = a^x$$

29. Graph *at least one* cycle of $y = 5\sin(4x) - 3$ on the set of axes below.

30. The cost of a brand-new electric-hybrid vehicle is listed at $33,400, and the average annual depreciation for the vehicle is 15%. The car's value can be modeled by the function $V(x) = 33,400(0.85)^x$ where x represents the years since purchase.

Julia and Jacob have each written a function that is equivalent to the original.

$$\text{Jacob's function: } V(x) = 33,400(0.1422)^{\frac{1}{12}x}$$

$$\text{Julia's function: } V(x) = 33,400(0.9865)^{12x}$$

Whose function is correctly rewritten to reveal the approximate monthly depreciation rate? Justify your answer.

31. Write a recursive formula for the sequence 8, 20, 50, 125, 312.5, ...

32. A grocery store orders 50 bags of oranges from a company's distribution center. The bags have a mean weight of 3.85 pounds per bag. The company claims that their bags of oranges have a mean weight of 4 pounds. The grocery store ran a simulation of 50 bags, 2500 times, assuming a mean of 4 pounds. The results are shown below.
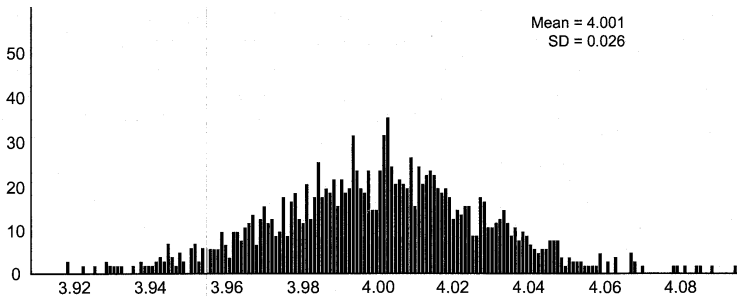
Is the mean weight of the grocery store's sample unusual? Explain using the results of the simulation.

ALGEBRA 2 – COMMON CORE
January 2025
Part III

   Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

33. At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let A be the event that the guest room has a view of the lake, and let B be the event that the guest room has a queen-size bed. Events A and B are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.
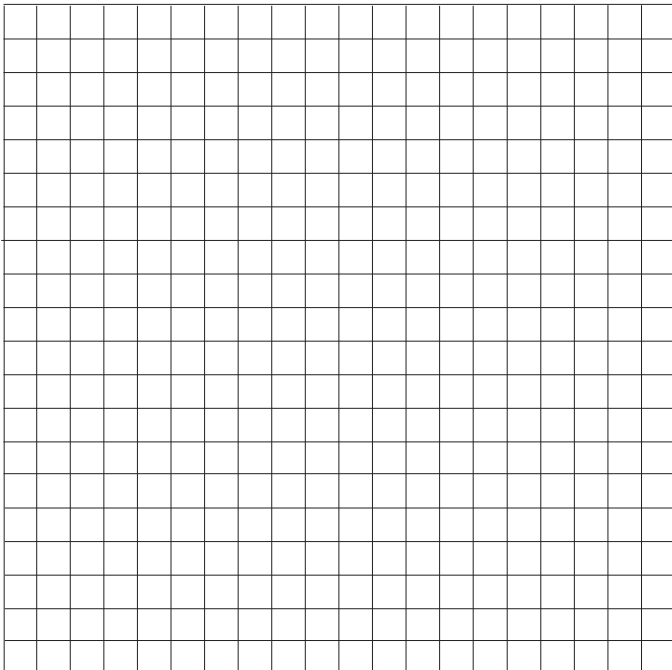
34. Which function has a greater average rate of change on the interval $[-1, 4]$? Justify your answer.

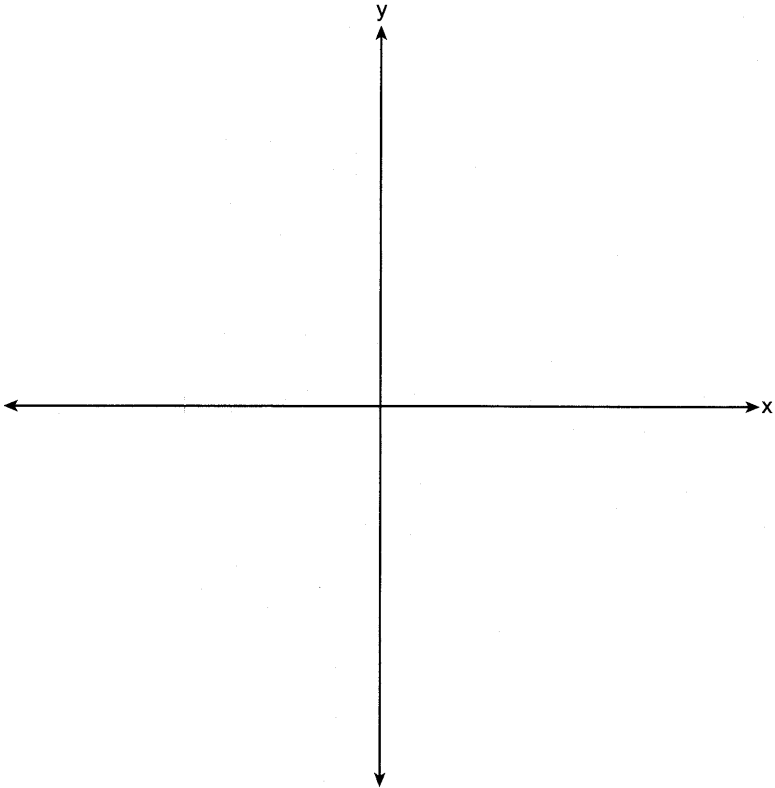| x	m(x)
-2	-3
-1	1
0	1
1	3
2	13
3	37
4	81
5	151

$p(x) = 3^x + 1$

35. Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$. (The use of the grid below is optional.)

36. Algebraically find the zero of $c(x) = x^3 + 2x^2 - 16x - 32$.

On the axes below, sketch $y = c(x)$.

Part IV

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided to determine your answer. Note that diagrams are not necessarily drawn to scale. A correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

37. The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0 e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

Graph $A(t)$ and $B(t)$ for $0 \leq t \leq 4$.
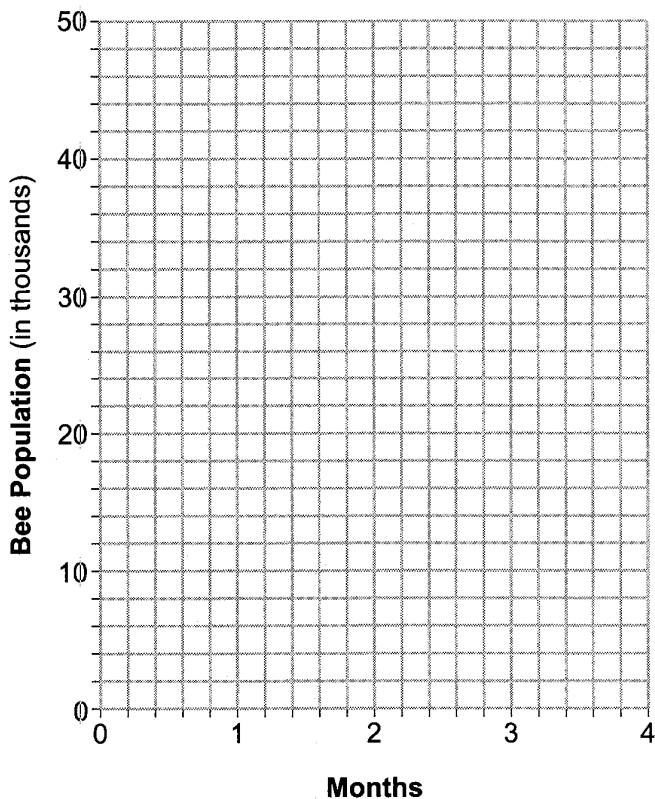
Months

Question 35 continued:

State, to the *nearest tenth of a month*, when the colonies will have the same population.

Determine algebraically how long it will take, *to the nearest tenth of a month,* for the population in Colony *A* to triple.