

Math for Modern Technology

Homework Problems

Instructions

- Each assignment is to be done on regular-sized notebook paper.
- Your name and the assignment number should appear at the top of the first sheet.
- Please do not use a red pen or red pencil to do the homework.
- All relevant work is **required**. Failure to show relevant work will result in a large point deduction.

Graded Homework 1

1. Which of the following points are on the graph of the equation $y = 4x - 9$?

$$(-9, 0), (0, -9), (-2, -17), (-2, -1), \left(\frac{4}{3}, \frac{11}{3}\right), (5, 11), \left(-\frac{1}{7}, -\frac{67}{7}\right)$$

2. Which of the following points are on the graph of the equation $5x - 2y = 6$?

$$(2, 2), (-3, 0), \left(0, \frac{6}{5}\right), (-2, -8), \left(\frac{1}{7}, -\frac{37}{14}\right)$$

3. Write the slope-intercept form of $4x - 3y = -1$.

4. Write the slope-intercept form of $\frac{1}{2}x + \frac{3}{7}y = \frac{5}{8}$.

5. Write the general form of $y = -5x + 8$. The coefficients of the general form must be integers.

6. Write the general form of $y = \frac{4}{5}x - \frac{1}{3}$. The coefficients of the general form must be integers.

7. Determine whether or not the following two linear equations have the same graph.

$$y = 3x - 2 \qquad 9x - 3y = 6$$

8. Determine whether or not the following two linear equations have the same graph.

$$y = \frac{7}{8}x + \frac{5}{3} \qquad 21x - 24y = 40$$

9. Determine whether or not the following two linear equations have the same graph.

$$4x + 3y = 12 \qquad \frac{1}{3}x + \frac{1}{2}y = 1$$

10. Determine whether or not the following two linear equations have the same graph.

$$x - 7y = 5 \qquad -\frac{3}{4}x + \frac{21}{4}y = -\frac{15}{4}$$

11. Sketch the graph of $y = 9x + 2$.

12. Sketch the graph of $y = -\frac{1}{3}x - \frac{1}{5}$.

13. Sketch the graph of $6x - 2y = 8$.

14. Sketch the graph of $\frac{1}{2}x + \frac{1}{4}y = -\frac{1}{2}$.

15. The following linear equation estimates the average income y (in dollars) for a family of four in country **Z** for x years after 1970.

$$y = 450x + 3700$$

A. Sketch a graph of this equation that includes the years 1970 and 2007.

B. Estimate the average income for a family of four in **Z** in 1995.

C. Predict the average income for a family of four in **Z** in 2007.

D. Predict the year during which the average income for a family of four in **Z** reaches \$25,000.

Graded Homework 2

1. Find the solution to the following system of equations.

$$3x + 5y = 3$$

$$5x - 2y = 5$$

2. Find the solution to the following system of equations.

$$10x - 7y = 13$$

$$-12x - 6y = -5$$

3. Find the solution to the following system of equations.

$$y = 3x - 2$$

$$x + 2y = 10$$

4. Find the solution to the following system of equations.

$$y = \frac{1}{3}x + \frac{1}{2}$$

$$y = -7x + 9$$

5. The supply curve for a product is $p = q + 20$ and the demand curve is $p = -q + 620$.
 - A. Determine the actual price of the product and the number of units sold.
 - B. Graph the supply and demand curves including the equilibrium point.
6. The supply curve for a product is $p = \frac{1}{5}q + 4$ and the demand curve is $p = -\frac{1}{4}q + 13$.
 - A. Determine the actual price of the product and the number of units sold.
 - B. Graph the supply and demand curves including the equilibrium point.

Graded Homework 3

1. Sketch the graph of the line which passes through the point $(-4, 5)$ and has slope $-\frac{3}{4}$.
2. Sketch the graph of the line which passes through the point $(2, 1)$ and has slope -6 .
3.
 - A. Find the slope-intercept form of the line with slope $\frac{1}{5}$ which passes through $(2, 0)$.
 - B. Find a general form of the above line.
4.
 - A. Find the slope-intercept form of the line with slope $-\frac{8}{7}$ which passes through $(-3, 5)$.
 - B. Find a general form of the above line.
5.
 - A. Find the slope-intercept form of the line which passes through the points $(-3, 2)$ and $(1, -6)$.
 - B. Find a general form of the above line.
6.
 - A. Find the slope-intercept form of the line which passes through the points $(-4, -1)$ and $(2, 2)$.
 - B. Find a general form of the above line.
7.
 - A. Find the slope-intercept form of the line $3x - 5y = 7$.
 - B. What is the slope of the above line?
 - C. What is the y -intercept of the above line?
8.
 - A. Find the slope-intercept form of the line $-4x + 10y = 17$.
 - B. What is the slope of the above line?
 - C. What is the y -intercept of the above line?

9. At the end of 1996 consumers in country **Z** owed 1,200 billion dollars (\$1,200,000,000,000) in outstanding credit, an amount which has been increasing by approximately 115 billion dollars per year since that time.
- A. Find an equation that estimates the outstanding consumer credit in billions of dollars y for x years after the end of 1996.
 - B. Estimate the amount consumers in **Z** owed in outstanding credit at the end of 2001.
 - C. Predict the amount that consumers in **Z** will owe in outstanding credit at the end of 2008.
 - D. Predict the year during which the amount consumers in **Z** owe in outstanding credit reaches 3,000 billion dollars.
10. In 1990 the average income for a family of four in country **Z** was \$13,000 and in 2005 the average income for a family of four was \$19,000. Assume a linear relationship between the average income and the year.
- A. Find a linear equation that estimates the average income y for a family of four in **Z** for x years after 1990.
 - B. Estimate the average income for a family of four in **Z** in 1995.
 - C. Predict the average income for a family of four in **Z** in 2008.
 - D. Predict the year during which the average income for a family of four in **Z** reaches \$25,000.
11. Z Software is releasing a new computer game. It cost the company \$150,000 to develop the game, and each game package costs Z Software an additional \$25. The company plans to sell the game packages for \$45 each. Let x be the number of game packages that Z Software produces and sells.
- A. Find the cost, revenue, and profit functions in terms of x .
 - B. How many game packages must Z Software produce and sell for the company to break even?
 - C. Sketch the cost, revenue, and profit functions on the same set of axes beginning with $x = 0$ on the x -axis. Show the break-even point on the sketch.

Graded Homework 4

1. Complete each part using the following data points: (1, 1), (4, 3), (2, 3), (6, 4), (5, 5), (7, 6).
- A. Find the least squares regression line. The coefficients of the regression line should be given to the nearest tenth.
 - B. Plot the scatter diagram and the least squares regression line.
 - C. Estimate y when $x = 9$.
 - D. Estimate x when $y = 8$.

2. Complete each part using the data given in the table below. Let x be the number of years since 1970 and y the per capita disposable personal income in country Z in thousands of dollars.

Year	Per Capita Disposable Personal Income (in thousands of dollars)
1970	3.60
1975	5.50
1980	8.80
1985	13.0
1990	17.1
1995	20.3
1996	21.1
1997	21.9
1998	23.1
1999	24.0
2000	25.4
2001	26.2
2002	27.2
2003	28.0
2004	29.5
2005	30.5

- A. Find the least squares regression line. The coefficients of the regression line should be given to three significant digits.
- B. Plot the scatter diagram and the least squares regression line.
- C. Predict the per capita disposable personal income in Z in 2007.
- D. Predict the year during which the per capita disposable personal income in Z will reach \$35,000.

Graded Homework 5

$$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$$

$$A = \{2, 4, 6, 8, 10, 12, 14\}$$

$$B = \{2, 5, 8, 11, 14\}$$

$$C = \{1, 3, 6, 8, 11, 12, 14\}$$

Find each of the following sets.

1. $A \cup B$
2. $A \cap B$
3. $A \cup B \cup C$
4. $A \cap B \cap C$
5. \bar{A}
6. \bar{B}

7. \overline{C}
8. \overline{U}
9. $\overline{A} \cap C$
10. $\overline{A} \cup C$
11. $\overline{B} \cap \overline{U}$
12. $\overline{A \cap B}$
13. $\overline{A} \cap \overline{B}$
14. $\overline{A \cup B}$
15. $\overline{A} \cup \overline{B}$

Graded Homework 6

1. Find $|A \cup B|$ if $|A| = 54$, $|B| = 39$, and $|A \cap B| = 17$.
2. Find $|A \cap B|$ if $|A| = 340$, $|B| = 68$, and $|A \cup B| = 372$.
3. Find $|A|$ if $|\overline{B}| = 52$ (Assume $U = A \cup B$.), $|A \cup B| = 93$, and $|A \cap B| = 29$.
4. A city neighborhood has 45 white houses, 67 two-story houses, and 16 two-story white houses. How many houses are either white or have two stories?
5. A car dealer has a group of 36 cars of which 25 are blue and 9 do not have white trim. How many of these cars are blue with white trim?
6. A video rental store has 70 titles that are either comedies or romances. Of these, 17 titles are both comedies and romances and 30 titles are not comedies. How many titles are not romances?

Graded Homework 7

1. In how many ways can a president, a secretary, and a treasurer be elected from among ten people?
2. In how many ways can 5 boys and 3 girls be seated in a row if:
 - A. There are no restrictions?
 - B. One of the girls, Sue, must be seated on the left end?
 - C. Boys sit together and girls sit together?
3. If 3 subjects are available for an 8:50 class and 5 other subjects for a 9:55 class, how many different class schedules are possible for a student who wishes to take one class at each time?
4. In how many ways can a 10 question multiple-choice test be answered if there are 4 choices for each question?
5. A microwave oven dealer has in stock 3 models, each available in 5 colors. How many different microwave oven selections are available for purchase?

6. Professor X is scheduling one hour individual Friday tutoring sessions for Ben, Nadine, Lisa, and Harold. The available times are 8:00 am, 9:00 am, 10:00 am, 11:00 am, 12:00 pm, and 1:00 pm.
 - A. How many ways can Professor X schedule the sessions?
 - B. How many ways can Professor X schedule the sessions if Ben's session must be at 11:00 am?
 - C. How many ways can Professor X schedule the sessions if Nadine's session must be before Lisa's?

Graded Homework 8

1. In how many ways can seven books be lined up four at a time on a shelf?
2. How many different four-card hands are possible from a standard deck of 52 cards?
3.
 - A. How many arrangements are there of the letters in the word *computer*?
 - B. How many arrangements are there if only 3 letters are used each time?
4. An art student is told to paint a picture using only 3 colors out of 24 available colors. How many ways can the three colors be chosen?
5. A committee of four is to be selected from among eight criminal justice majors and a professor to meet with the Dean. In how many ways can this committee be selected if
 - A. There are no restrictions?
 - B. The professor must be on the committee?
 - C. The professor cannot be on the committee?
6. The Public Service and Business Management departments each send three representatives to a conference. At the conference a committee of four is to be selected from among these representatives. In how many ways can this be done if
 - A. There are no restrictions?
 - B. Exactly two are to come from Public Service?
 - C. Exactly three are to come from Business Management?
7. Six members of the Akron Fire Department are to receive awards for outstanding performance of duties during the past year. In how many different orders can the awards be distributed?
8.
 - A. The finance committee of the Akron Abstract Mathematics Museum has 14 members. The committee must select a chair, a secretary, and a treasurer. If no person is permitted to hold more than one office, how many ways can the positions be filled?
 - B. The committee plans to form a 5-person subcommittee to study the feasibility of expanding the topology exhibit. How many ways can this be done?

9. In how many ways can a five-card hand be dealt from a 52-card deck if
- A. All the cards are clubs?
 - B. Exactly two are clubs, two are diamonds, and one is a spade?
 - C. All are to be hearts or all are to be black cards?
10. In how many ways can a three-card hand be dealt from a 52-card deck if
- A. All the cards are red?
 - B. All the cards are face cards?
 - C. At least one card is a face card?

Graded Homework 9

1. An experiment consists of rolling a die and tossing a quarter.
- A. How many outcomes does the experiment have?
 - B. Write the sample space.
 - C. Write the probability distribution.
 - D. What is the probability that the die roll is three?
 - E. What is the probability that the quarter toss is tails?
 - F. What is the probability that the die roll is less than five?
 - G. What is the probability that the die roll is even?
 - H. What is the probability that the die roll is a six or the quarter toss is tails?
 - I. What is the probability that the die roll is even or the quarter toss is heads?
 - J. What is the probability that the die roll is less than 5 or the quarter toss is heads?

2. An experiment consists of tossing a penny, a nickel, a dime, and a quarter.
- A. How many outcomes does the experiment have?
 - B. Write the sample space.
 - C. Write the probability distribution.
 - D. What is the probability that the nickel toss is tails?
 - E. What is the probability that the penny toss is heads or the quarter toss is tails?
 - F. What is the probability that none of the tosses are heads?
 - G. What is the probability that exactly one of the tosses is heads?
 - H. What is the probability that exactly two of the tosses are heads?
 - I. What is the probability that exactly three of the tosses are heads?
 - J. What is the probability that all four of the tosses are heads?
 - K. What is the probability that at least two of the tosses are tails?
 - L. What is the probability that at most three of the tosses are tails?
 - M. What is the probability that at exactly three of the tosses are tails or exactly two of the tosses are heads?
3. A survey of 25 students asked how many classes they had skipped in the last week.
- 7 skipped 0 classes
 - 10 skipped 1 class
 - 6 skipped 2 classes
 - 2 skipped 3 classes
- A. Write the probability distribution.
 - B. What is the probability that a student skipped either no classes or three classes?
 - C. What is the probability that a student skipped an odd number of classes?
 - D. What is the probability that a student skipped at least one class?
 - E. What is the probability that a student skipped at most two classes?
 - F. What is the probability that a student skipped either at least one class or at most two classes?

Graded Homework 10

1. A bag contains 6 red balls, 9 green balls, and 4 yellow balls. Five balls are selected from the bag.
 - A. What is the probability of selecting 4 yellow balls?
 - B. What is the probability of selecting 2 red balls and 3 green balls?
 - C. What is the probability of selecting 2 red balls?
 - D. What is the probability of selecting 3 green balls?
 - E. What is the probability of selecting 2 red balls or 3 green balls?
 - F. What is the probability of selecting no yellow balls?
 - G. What is the probability of selecting no green balls?
2. A group of people contains 6 women and 5 men. A committee of 4 is to be selected from this group.
 - A. What is the probability of choosing exactly 3 women for the committee?
 - B. What is the probability of choosing exactly 3 men for the committee?
 - C. What is the probability of choosing exactly 2 women for the committee?
 - D. Sue is one of the women in the group. What is the probability of choosing Sue to be on the committee?
 - E. Fred and Barney are two of the men in the group. What is the probability of choosing Fred and Barney to be on the committee?
 - F. What is the probability of choosing Fred to be on the committee?
 - G. What is the probability of choosing Barney to be on the committee?
 - H. What is the probability of choosing either Fred or Barney to be on the committee?
3. A four-card hand is to be selected from a 52-card deck.
 - A. What is the probability that all of the cards are diamonds?
 - B. What is the probability that exactly two of the cards are threes?
 - C. What is the probability that none of the cards is a jack?
4. A group of people contains 10 supporters of an issue and 5 who don't support the issue. A committee of 5 is to be chosen to decide the issue. What is the probability that a majority of the committee will not support the issue?

Graded Homework 11

1. The frequency distribution for quiz scores in a math class is given below.

Score	Frequency
0	4
1	7
2	19
3	16
4	8
5	2

- A. Write the relative frequency distribution.
- B. Draw the relative frequency histogram.
2. A group of slackers were asked how many hours each day they spend playing video games. The results are shown below.

Hours/Day	Frequency
0	2
1	14
2	20
3	42
4	25
5	6
6	7
7	3
8	1

- A. Write the relative frequency distribution.
- B. Draw the relative frequency histogram.
3. A penny, nickel, dime and quarter are flipped and the number of heads is recorded.
- A. Write the probability distribution.
- B. Draw the probability histogram.
4. A two-card hand is drawn from a 52-card deck. If both cards are face cards, the hand counts as 3 points. If both cards are in the same suit and at most one is a face card, the hand counts as 2 points. If one card is a heart and the other a diamond, or one card is a club and the other is a spade, and the hand has at most one face card, the hand counts as one point. If the hand is none of the above types, the hand counts as zero points.
- A. Write the probability distribution.
- B. Draw the probability histogram.

Graded Homework 12

1. The exam scores for two classes are given below. Determine the mean score for each class and the mean score for both classes put together. Which class did better on the exam?

Class A			Class B		
57	63	29	50	44	44
85	93	43	80	94	94
99	90	80	74	78	68
71	59	53	37	86	74
60	60	84	87	89	93

2. The per capita disposable personal income in thousands of dollars for 2006 for the residents of large cities of country **Z** are listed below. Compute the mean of this data. How many cities have a per capita disposable income above the mean? Below the mean?

31.1 25.2 31.0 25.9 23.5 31.1 32.3 38.6 31.6 44.5
 28.5 29.2 24.5 30.9 27.2 28.2 28.0 24.5 25.0 27.0
 34.5 36.6 28.7 31.9 22.7 27.5 25.1 29.3 30.3 33.1

3. The table below gives the number of credit cards owned by each member of a group of students. Compute the mean of this data. How many students own more than the mean number of credit cards? What percentage of the students own more than the mean number of credit cards?

x	# students with x credit cards
0	19
1	8
2	7
3	3
4	6
5	3
6	1
7	1
9	1
11	1

4. Use the table given below to determine the mean number of computers owned by the members of a GNU/Linux users group. What percentage of members own fewer than the mean number of computers?

# Computers	Relative Frequency
1	0.22
2	0.37
3	0.19
4	0.08
5	0.10
6	0.02
7	0.02

5. A player rolls a pair of dice. If their sum is 6 or less, the player wins \$9. Otherwise the player loses \$7. What are the player's expected earnings?

6. A player draws one card from a 52-card deck. If the card is an ace or a king, the player wins \$3. If the card is a queen, jack, or ten, the player wins \$1. Otherwise the player loses \$1.50. What are the player's expected earnings?
7. A math exam has 5 true-false questions, and 6 multiple-choice questions with four choices each.
 - A. If a student guesses at the answer to each question, what is the expected number of correct answers?
 - B. Is it likely that a student who guesses the answer to each question will pass the exam? Explain your answer.

Graded Homework 13

1. The exam scores for a course and the two classes taking the course are given below.

Course						Class A			Class B		
57	63	29	50	44	44	57	63	29	50	44	44
85	93	43	80	94	94	85	93	43	80	94	94
99	90	80	74	78	68	99	90	80	74	78	68
71	59	53	37	86	74	71	59	53	37	86	74
60	60	84	87	89	93	60	60	84	87	89	93

- A. Compute μ and σ for the course.
- B. If a score greater than $\mu - \sigma$ is passing, how many students in the course passed the exam?
- C. If a score greater than $\mu + \sigma$ is an *A*, how many students in the course received an *A* on the exam?
- D. Compute \bar{x} and s for class **A**.
- E. If a score greater than $\bar{x} - s$ is passing, how many students in class **A** passed the exam?
- F. If a score greater than $\bar{x} + s$ is an *A*, how many students in class **A** received an *A* on the exam?
- G. If μ and σ are used to determine the grades for class **A**, how many students in that class passed the exam and how many received an *A* on it?
- H. Compute \bar{x} and s for class **B**.
- I. If a score greater than $\bar{x} - s$ is passing, how many students in class **B** passed the exam?
- J. If a score greater than $\bar{x} + s$ is an *A*, how many students in class **B** received an *A* on the exam?
- K. If μ and σ are used to determine the grades for class **B**, how many students in that class passed the exam and how many received an *A* on it?

2. **A.** The per capita disposable personal income in thousands of dollars for 2006 for the residents of large cities of country **Z** are listed below. Compute the mean and standard deviation of this data.

31.1 25.2 31.0 25.9 23.5 31.1 32.3 38.6 31.6 44.5
 28.5 29.2 24.5 30.9 27.2 28.2 28.0 24.5 25.0 27.0
 34.5 36.6 28.7 31.9 22.7 27.5 25.1 29.3 30.3 33.1

- B.** A sample of the above data is listed below. Compute the sample mean and sample standard deviation.

31.1 25.2 31.0 25.9 23.5 31.1 32.3 38.6
 34.5 36.6 28.7 31.9 22.7 27.5 25.1 29.3

- C.** Is the sample a good sample? Explain your answer.

3. The table below gives the number of credit cards owned by each member of a sample of a group of students. Compute the mean (\bar{x}) and standard deviation (s) of this data. How many students own more than $\bar{x} + s$ number of credit cards?

x	# students with x credit cards
0	19
1	8
2	7
3	3
4	6
5	3
6	1
7	1
9	1
11	1

Graded Homework 14

1. The serum cholesterol levels of residents of country **Z** aged 20 and over are normally distributed with a mean of 202 mg/dL and a standard deviation of 40.
- A.** Find the percentage of residents whose cholesterol levels are between 180 and 220.
- B.** Find the percentage of residents whose cholesterol levels are greater than 240. Cholesterol levels greater than 240 are considered to be high.
- C.** Find the percentage of residents whose cholesterol levels are between 150 and 190.
- D.** In a random sample of 250,000 residents, how many would be expected to have cholesterol levels between 180 and 220? How many would be expected to have cholesterol levels greater than 240? How many would be expected to have cholesterol levels between 150 and 190?
2. A manufacturer of compact fluorescent light bulbs determines that the life span of the bulbs is normally distributed with a mean of 5 years and a standard deviation of 6 months. If the light bulbs are guaranteed for 4 years after the date of purchase, what percentage will the manufacturer need to replace? If 4 million bulbs are sold, how many will burn out before the warranty expires?

3. The yearly rainfall in city **Z** is normally distributed with a mean of 47 inches and a standard deviation of 10 inches. What percentage of years have received more than 70 inches of rain?

Graded Homework 15

1. The probability that a person acquires disease **X** during their lifetime is 36%. What is the probability that at most half of a group of 100 people will acquire disease **X** during their lifetimes?
2. The probability of precipitation in city **Z** during any given day is 27%. What is the probability that **Z** will have between 80 and 110 days with precipitation during this year?
3. When shooting at a target, the probability that a certain archer hits the bullseye with the arrow is 67%. If the archer takes 200 shots, what is the probability that the archer hits the bullseye at least 145 times?
4. When playing a round of gambling game **Z**, a player either wins \$5 or loses \$8. The probability that a player wins \$5 is 49%. If a player plays 50 rounds of game **Z**, what is the probability that the player makes money?

Graded Homework 16

1. If \$1500 is invested at 6.8%, how much is in the account after 7 years if the interest is compounded
 - A. quarterly?
 - B. monthly?
 - C. daily?
2. If \$16,500 is needed in 5 years, what amount should be deposited now into an account that earns 7.3% compounded
 - A. quarterly?
 - B. monthly?
 - C. daily?
3. An account with a rate of 3.2% compounded monthly will have a balance of \$10,000 after 3 years. What will the balance be after 6 years?
4. What is the effective rate if the interest rate is 5.7% compounded
 - A. quarterly?
 - B. monthly?
 - C. daily?
5. Is it better to earn 15% compounded daily or 15.1% compounded weekly?

Graded Homework 17

1. An investor will deposit \$250 each month into an account that pays 6.5% compounded monthly. How much will be in the account in 25 years?
2. An investor wishes to make monthly equal payments into an account that pays 8.1% compounded monthly. What is the amount of one payment if the investor wishes to have \$250,000 in the account in 35 years?
3. Fred's daughter Pebbles will be 18 soon. When Pebbles turns 18, Fred plans to deposit enough money into an account that pays 9% compounded semiannually so that Pebbles may withdraw \$3150 every six months for four years. How much should Fred deposit into the account?
4. Barney deposits \$85,000 into an account that pays 7.4% compounded quarterly. Barney plans to withdraw from the account equal amounts at the end of each quarter for six years, leaving nothing in the account at the end. How much may Barney withdraw at the end of each quarter?

Graded Homework 18

1. A buyer borrows \$15,000 at 11.3% compounded monthly for 30 months in order to purchase a car.
 - A. How much is one payment?
 - B. What is the unpaid balance after 15 months?
 - C. How much interest will be paid during the first 15 months?
 - D. How much interest will be paid during the final 15 months?
 - E. How much of the first payment is applied to the principal?
 - F. How much of the last payment is applied to the principal?
2. A buyer purchases retail space for \$750,000. The buyer takes out a 15-year mortgage at 6.5% compounded monthly to finance the purchase.
 - A. How much is one payment?
 - B. How much interest is paid with the 90th payment?
 - C. How much of the 90th payment is applied to the principal?
 - D. How much is applied to the principal during the first year?
 - E. How much interest is paid during the first year?
 - F. How much is applied to the principal during the 14th year?
 - G. How much interest is paid during the 14th year?