Math E-3

Assignment 10 **Total possible points: 60**

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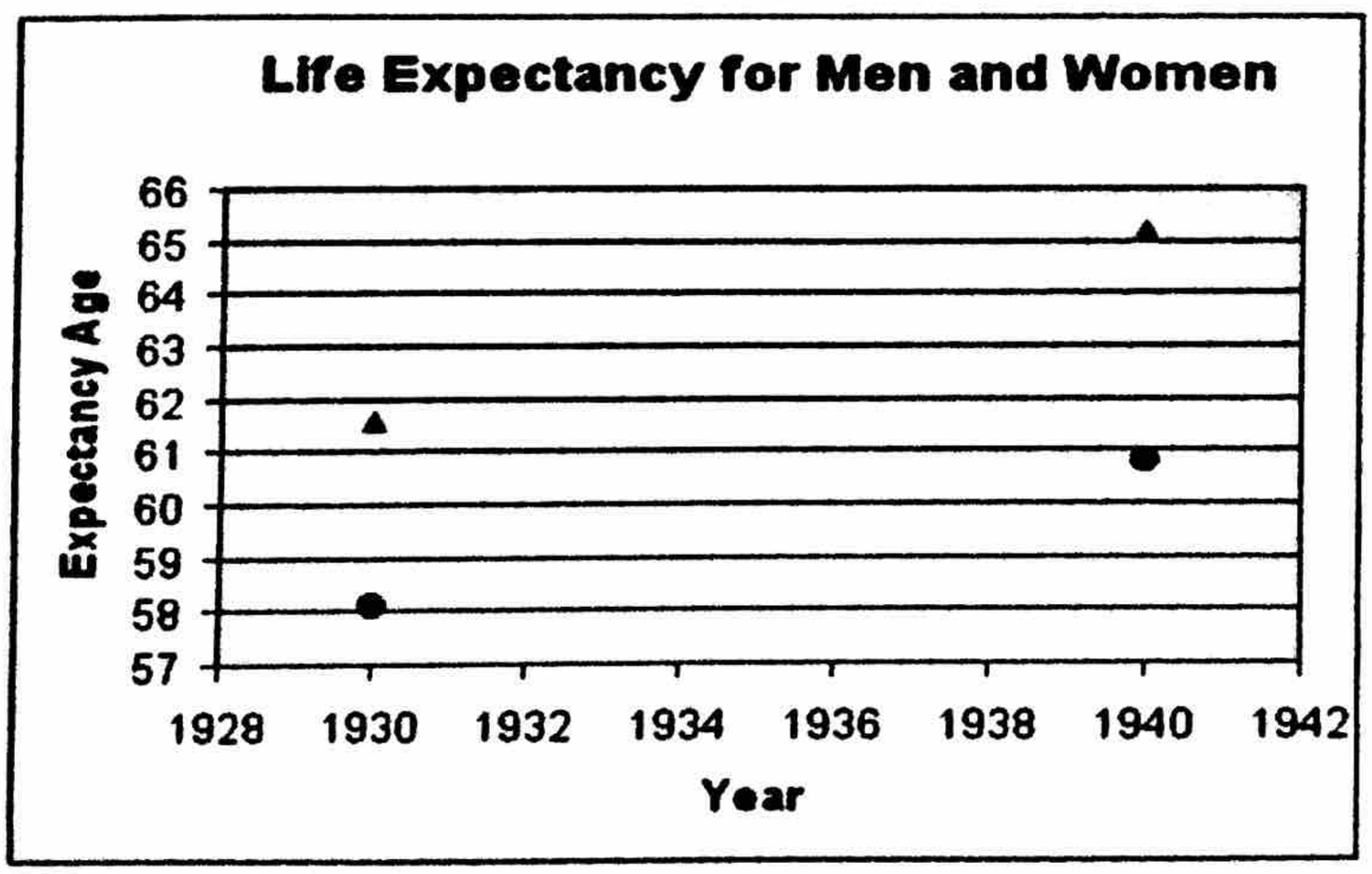
Note: For all the following problems, be sure to label all axes and insert a title of some kind. Make sure your intervals on the axes are even. Remember, do not break the x-axis unless you feel extremely comfortable with graphing techniques. Use Examples 3 and 4 from the reading as models for problems 5-24.

Problems 1-4

For these problems, do not find regression equations. Here we are learning to interpolate and extrapolate using only two data values.

The Life Expectancy of men and women born in the United States increased each decade from 1900 to 1950. The data for two of those decades appears below as well as a graph showing these data.

Year	Male Life Expectancy (Years)	Female Life Expectancy (Years)
1930	58.1	61.6
1940	60.8	65.2



1) The values for men and women for this data have been plotted on the same set of axes. Draw in the lines on the chart above that connect the two values. You will have two separate lines: One for men and one for women. Notice how much steeper the line for women is. What does that tell you? (2 points)

Females have a higher life expectancy than males between 1930-1940.
In 1930, females have a higher life expectancy of 3.5 years, $3.5 = 61.6 - 58.1$
In 1940, females have a higher life expectancy of 4.4 years, $4.4 = 65.2 - 60.8$

Use linear interpolation as demonstrated in Example 1 in the lecture notes to answer the questions that follow.

2) Using linear interpolation, determine the approximate life expectancy of men and women in 1934. (4 points)

Male Life Expectancy in 1934

S1 $60.8 - 58.1 = 2.7$
S2 $1940 - 1930 = \frac{2.7}{10} = .27$

S3 $1930 \xrightarrow{4\text{years}} 1934$
$58.1 + 4(.27) =$ Male Life Expectancy 59.18 years

Female Life Expectancy in 1934

S1 $65.2 - 61.6 = \frac{3.6}{10} = .36$
S2 $1940 - 1930 = \frac{3.6}{10} = .36$

S3 $1930 \xrightarrow{4\text{years}} 1934$
$61.6 + 4(.36) =$ Female Life Expectancy 63.04 years

3) Using extrapolation, determine the approximate life expectancies for men and women in 1960. (4 points)

Male Life Expectancy in 1960

S1 $60.8 - 58.1 = 2.7$
$1940 - 1930 = \frac{2.7}{10} = .27$

S2 $1960 - 1940 = 20$

S3 $1940 \xrightarrow{20\text{years}} 1960$
$60.8 + 20(.27) =$ Male Life Expectancy 66.2 years

Female Life Expectancy in 1960

$65.2 - 61.6 = \frac{3.6}{10} = .36$
$1940 - 1930 = \frac{3.6}{10} = .36$

$1960 - 1940 = 20$

$1940 \longrightarrow 1960$
$65.2 + 20(.36) =$ Female Life Expectancy 72.4 years

4) How confident are you of your predictions? Are you as sure of the extrapolation as the interpolation? Why or why not? (2 points)

Extrapolation will not be as accurate as interpolation because extrapolation is used to make predictions outside of known data values.

Im more confident in the life expectancy values in 1934 than I am in 1960.

Problems 5-11

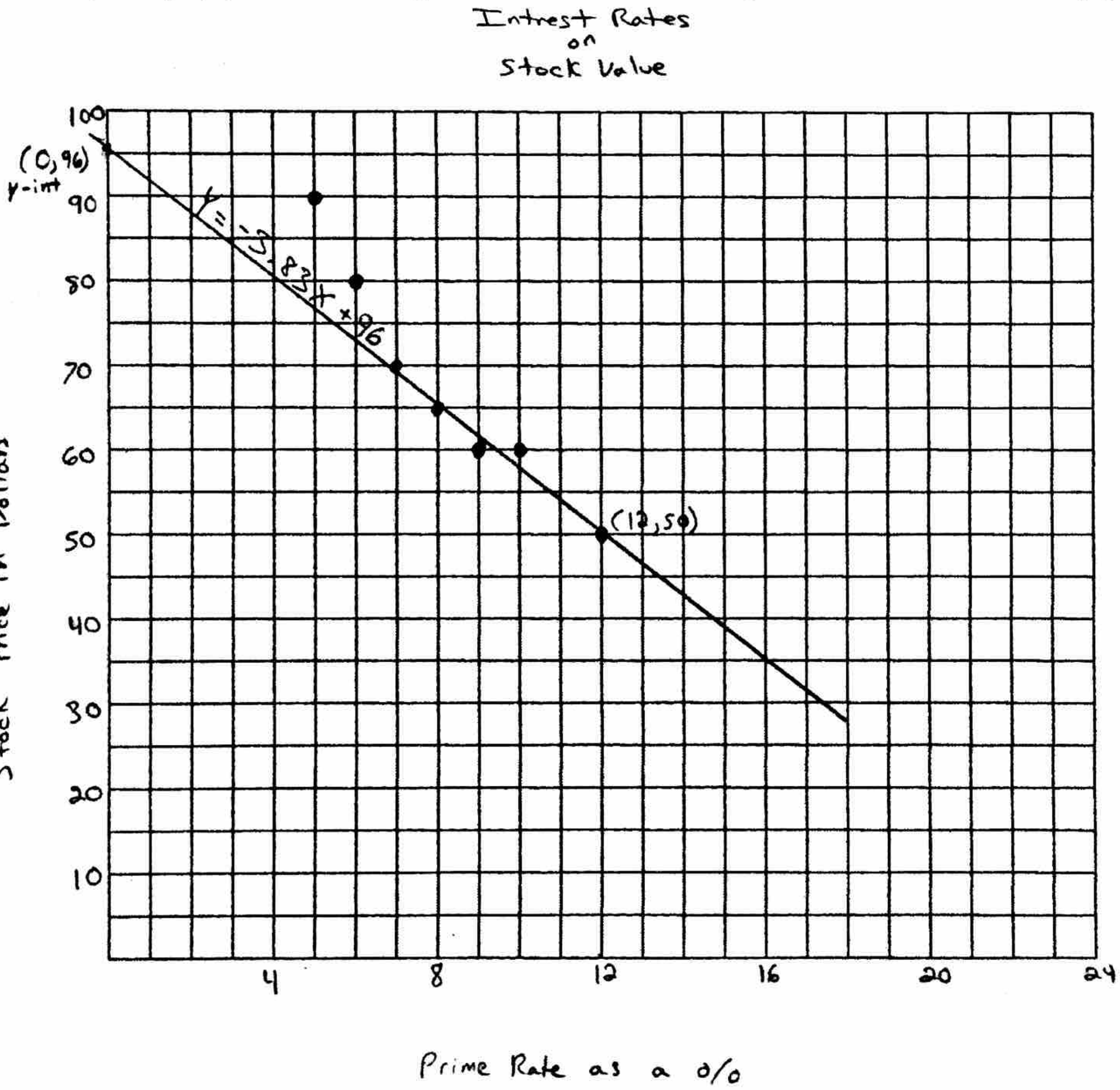
Some economists believe that as the prime interest rate increases, the value of stocks decreases. The table below gives data collected over a certain time period, comparing the prime rate with the value of a particular stock.

Prime Rate as a %	10	6	5	7	12	8	9
Stock Price in Dollars	60	80	90	70	50	65	60

5) Graph the data on a scatterplot below. Put the prime interest rate on the horizontal axis.

Why? The stock value depends on the prime interest rate. **(2 points)**

6) **By eye, draw below a regression line below that best represents the *trend* of the data. (2 points)**



9) **Describe in words what the slope AND y-intercept mean for these data. (2 points)**

Meaning of slope: Per interest rate, the stock price will drop $3.83.

Meaning of y-intercept: If there was no interest, the stock price will be an average of $96.00.

10) **Use your equation to predict the stock prices which correspond to the following prime interest rates: (do not estimate the answers from your graph although these estimates should match your answers calculated *from your equation*.) (4 points)** $Y = -3.83X + 96$

i) 11%

$53.87 = -3.83(11) + 96$

Stock price is $53.87 at 11% interest.

ii) 1%

$92.17 = -3.83(1) + 96$

Stock price is $92.17 at 1% interest.

iii) 15%

$38.55 = -3.83(15) + 96$

Stock price is $38.55 at 15% interest.

iv) 30%

$-18.9 = -3.83(30) + 96$

11) **Do any of your answers from question 10 look unrealistic? Discuss possible reasons. (1 point)**

-$18.90 for a interest rate of 30% is not realistic.

You cannot put interest on no money since there is nothing to put interest on.

7) **Describe in words the kind of correlation between the two variables. Give an estimate for Pearson's r-value. (2 points)**

Description of correlation: Strong Negative Correlation

As the prime interest rate increase the stock price in dollars decrease. The lower the interest rate, the higher the stock price.

Estimate of Pearson's r value: r = .-7

8) **Find the equation of your regression line. In your work, show the calculation of slope. Use either the y-intercept that you drew above in your graph, or use a point on your line to calculate the y-intercept. Either method is acceptable. (4 points)**

$Y = mX + b$ $\quad b = 96$ $\quad$ Points (0,96)(12,50)

$$m = \frac{(96-50)}{(0-12)} = \frac{46}{-12} = -3.83$$

$Y = -3.83X + 96$

Problems 12 -18

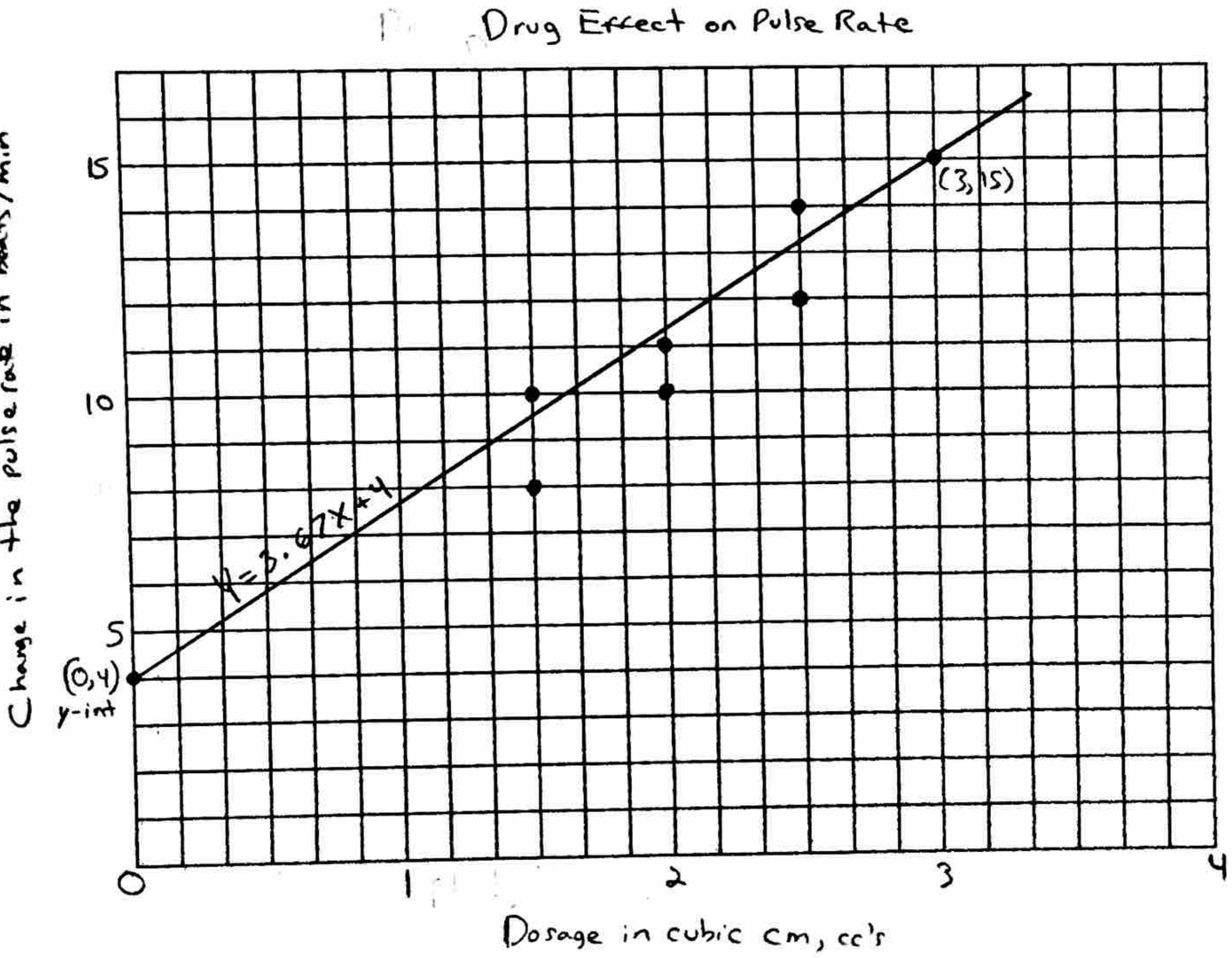
A pharmaceutical researcher wishes to know, as precisely as possible, the effect that a new drug will have on the human pulse rate. To investigate this effect, he administers different doses of the drug to each of seven randomly selected patients, and he notes the increase in their pulse rates one hour later.

Patient	A	B	C	D	E	F	G
Dosage in cubic cm, cc's	1.5	2	2.5	1.5	3	2	2.5
Change in the pulse rate in beats/min	8	10	14	10	15	11	12

12) **Draw a scatterplot of the data. Put the dosage on the horizontal axis.**

Why? Pulse Rate Depends on Dosage Received (2 points)

13) **Draw by eye the best fitting regression line below. (2 points)**



14) **Describe in words the kind of correlation between the two variables. Estimate an 'r' value for your relationship. (2 points)**

Description of correlation: Strong Positive Correlation

As the dosage of drug increases, pulse rate increases.
The lower the dosage, the lower the pulse rate.

Estimation of r value: r = .6

15) **Find the equation of your regression line. In your work, show the calculation of slope. Use either the y-intercept that you drew above in your graph, or use a point on your line to calculate the y-intercept. Either method is acceptable. (4 points)**

$Y = mX + b$

$b = 4$

$m = 3.67$

Points
(0,4) (3,15)

$m = \frac{(4-15)}{(0-3)} = \frac{-11}{-3} = \frac{11}{3}$ or 3.67

$Y = 3.67X + 4$

16) Describe in words what the slope and the y-intercept of your equation mean for these data. (2 points)

Meaning of slope: For each dosage of the drug, the pulse rate increases 3.67 beats per minute.

Meaning of y-intercept: When no drug is given, the pulse rate is 4 beats per minute.

17) Use your regression line to predict the change in pulse rate which corresponds to the following dosages: (3 points) $Y = 3.67X + 4$

i) 2.8 cc's (Interpolation)

$14.276 = 3.67(2.8) + 4$

14.28 beats per minute

ii) 4.0 cc's (Interpolation)

$18.68 = 3.67(4.0) + 4$

18.68 beats per minute

iii) 8.0 cc's (Extrapolation)

$33.36 = 3.67(8.0) + 4$

33.36 beats per minute

18) Do any of these answers seem unreasonable? Why? (1 point)

No, these values do not seem unreasonable given when drug dosage increase, pulse rate increases. However, the 8.0 dosage may be off due to extrapolation.

Problems 19 - 24

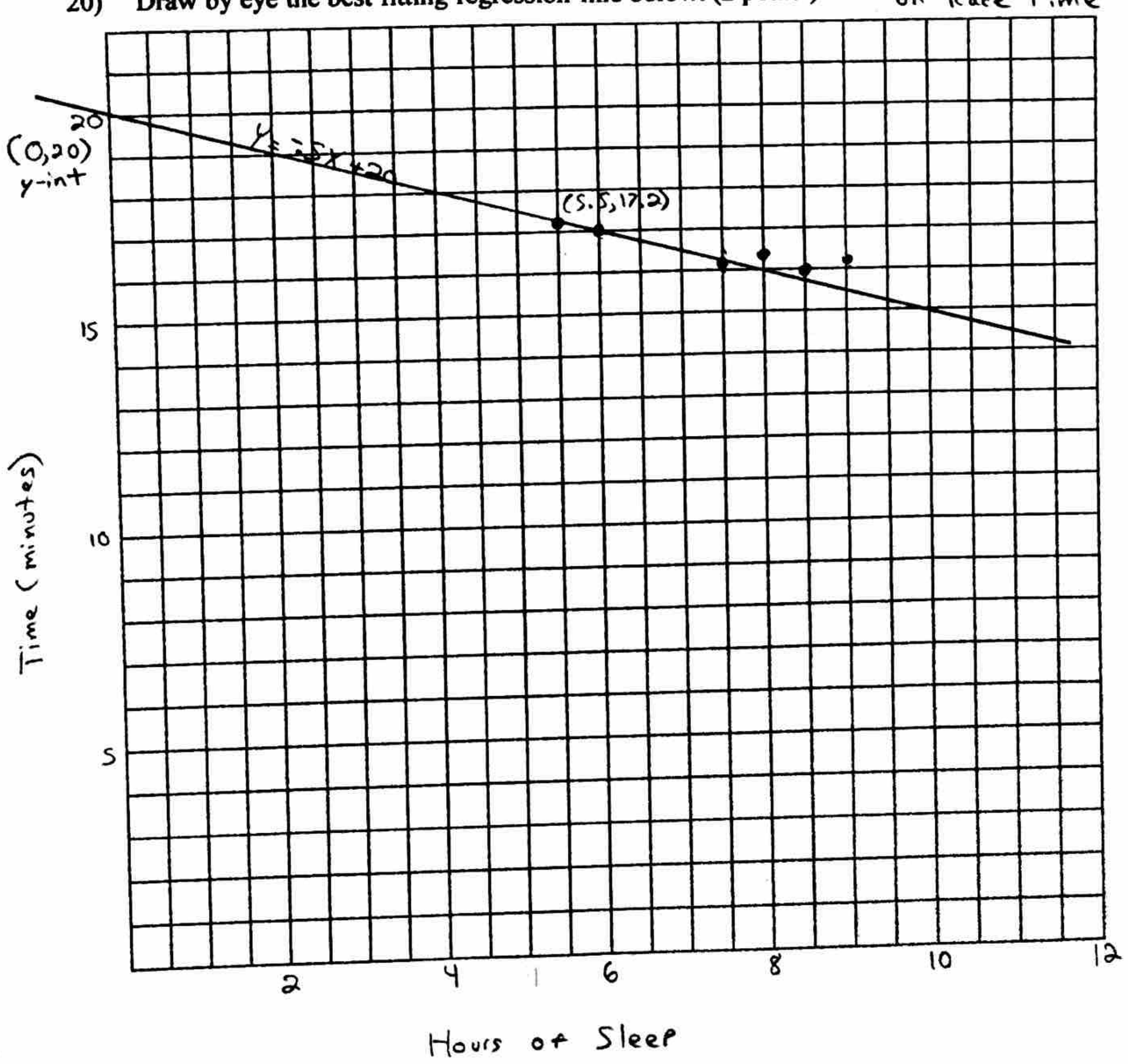
A student athlete noticed that his race times were affected by the amount of sleep that he got the night before a race. To understand this factor better, he recorded his nightly sleep in hours and his performance in a 5k race the following day.

Hours of sleep	8	7.5	5.5	9	6	8.5
Time (minutes)	16.5	16.3	17.2	16.2	17	16

19) Graph the data on a scatterplot below. Put the hours of sleep on the horizontal axis.

Why? Hours of Sleep determines the athlete race time. (2 points)

20) **Draw by eye the best fitting regression line below. (2 points)**



21) **Describe in words the kind of correlation between the two variables. Give an estimate for Pearson's r-value. (2 points)** As the student athlete gets more hours of sleep, the lower the time in minutes of the race. As the student athlete gets less sleep, the more the time in minutes of the race.

Strong negative correlation

Estimate of Pearson's r value: $r = -.8$

22) **Find the equation of your regression line. In your work, show the calculation of slope. Use either the y-intercept that you drew above in your graph, or use a point on your line to calculate the y-intercept. Either method is acceptable. (4 points)**

$Y = mX + b$

$b = 20$

$m = -.5$

Points

(0,20) (6,17)

$m = \frac{(20-17)}{(0-6)} = \frac{3}{-6} = -.5$

$Y = -.5X + 20$

23) Describe in words what the slope **AND** y-intercept mean for these data. (2 points)

Meaning of slope: For each increment of hours of sleep, the student athlete time will drop .5 min.

Meaning of y-intercept: If the student athlelet doesn't get any sleep at all, the student athlete run time will be at a constant of 20 min.

24) Use your <u>equation</u> to predict the race times which correspond to the following nightly sleep times: (do not estimate the answers from your graph although these estimates should match your answers calculated *from your equation.*) (3 points)

$$Y = -.5x + 20$$

i) 4 hours

$$18 = -.5(4) + 20$$

Run time is 18 minutes

ii) 7 hours

$$16.5 = -.5(7) + 20$$

Run time is 16.5 minutes

iii) 10 hours

$$15 = -.5(10) + 20$$

Run time is 15 minutes