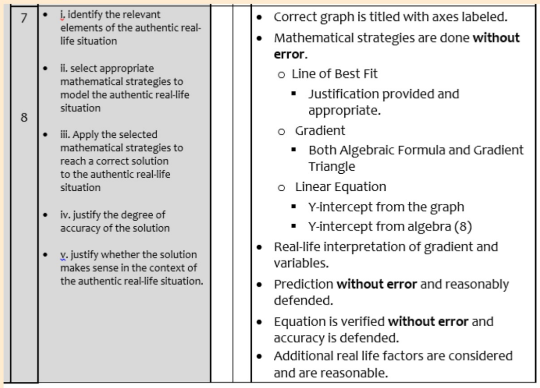
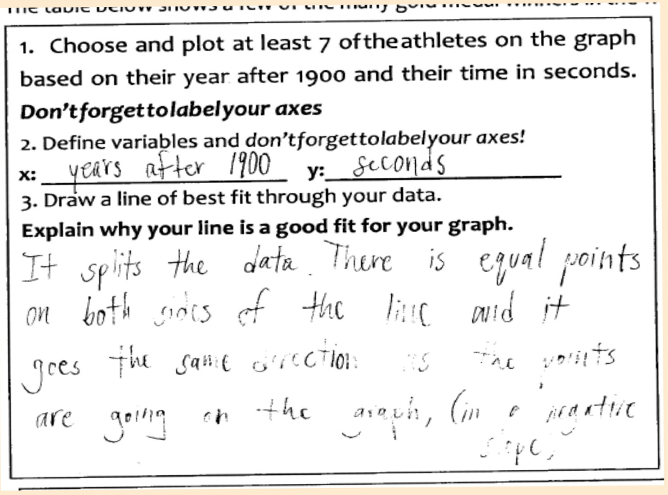
Unit 1: Relationships, Quiz 1 Exemplars!

Use these exemplars to examine and grow from your mistakes!



7 8	• i. identify the relevant elements of the authentic real-life situation • ii. select appropriate mathematical strategies to model the authentic real-life situation • iii. Apply the selected mathematical strategies to reach a correct solution to the authentic real-life situation • iv. justify the degree of accuracy of the solution • v. justify whether the solution makes sense in the context of the authentic real-life situation.			• Correct graph is titled with axes labeled. • Mathematical strategies are done **without error**. o Line of Best Fit ▪ Justification provided and appropriate. o Gradient ▪ Both Algebraic Formula and Gradient Triangle o Linear Equation ▪ Y-intercept from the graph ▪ Y-intercept from algebra (8) • Real-life interpretation of gradient and variables. • Prediction **without error** and reasonably defended. • Equation is verified **without error** and accuracy is defended. • Additional real life factors are considered and are reasonable.

Women's 100 m Olympic times



The table below shows a few of the many gold medal winners in the

1. Choose and plot at least 7 of the athletes on the graph based on their year after 1900 and their time in seconds. ***Don't forget to label your axes***

2. Define variables and *don't forget to label your axes!*

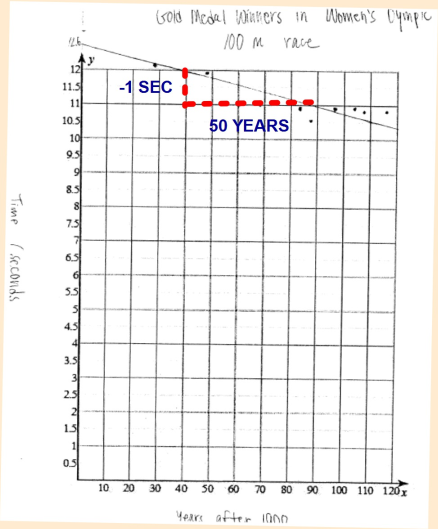
x: years after 1900 **y:** seconds

3. Draw a line of best fit through your data.

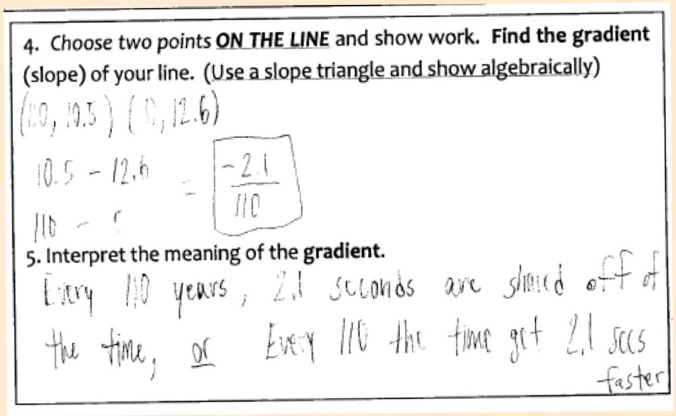
Explain why your line is a good fit for your graph.

It splits the data. There is equal points on both sides of the line and it goes the same direction as the points are going on the graph, (in a negative slope)

Women's 100 m Olympic times



Women's 100 m Olympic times



4. *Choose two points* ***ON THE LINE*** and show work. **Find the gradient** (slope) of your line. (Use a slope triangle and show algebraically)

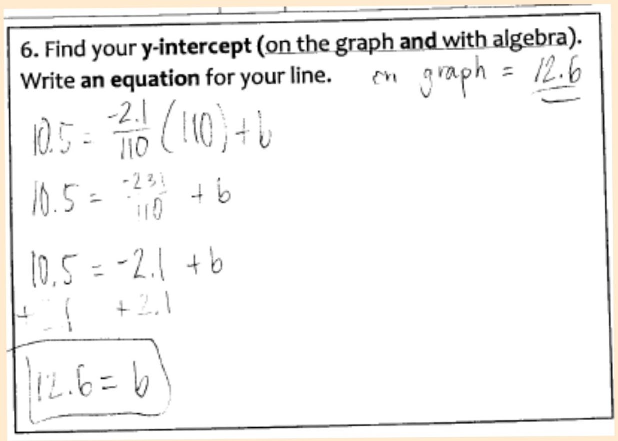
(110, 10.5) (0, 12.6)

$$\frac{10.5-12.6}{110-0} = \boxed{\frac{-2.1}{110}}$$

5. Interpret the meaning of the **gradient.**

Every 110 years, 2.1 seconds are shaved off of the time, or Every 110 the time get 2.1 secs faster

Women's 100 m Olympic times



6. Find your **y-intercept** (on the graph **and** with algebra). Write **an equation** for your line. on graph = 12.6

$10.5 = \frac{-2.1}{110}(110) + b$

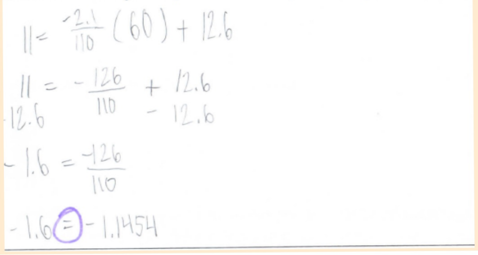
$10.5 = \frac{-231}{110} + b$

$10.5 = -2.1 + b$

$+2.1 \quad +2.1$

$\boxed{12.6 = b}$

Women's 100 m Olympic times



7. i) **Verify** your equation by choosing a data point from the table
o substitute into your equation. **Chosen point:** (60 , 11)

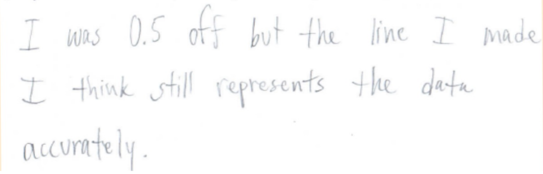
$11 = \frac{-2.1}{110}(60) + 12.6$

$11 = -\frac{126}{110} + 12.6$

$-12.6 \quad -12.6$

$-1.6 = \frac{-126}{110}$

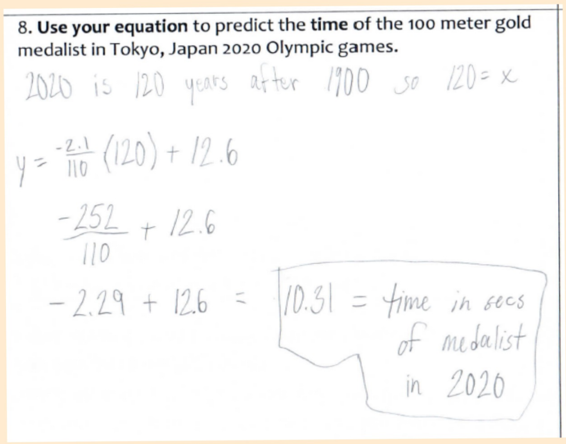
$-1.6 \neq -1.1454$



7. ii) **How well does your equation represent your points?**

I was 0.5 off but the line I made I think still represents the data accurately.

Women's 100 m Olympic times



8. **Use your equation** to predict the **time** of the 100 meter gold medalist in Tokyo, Japan 2020 Olympic games.

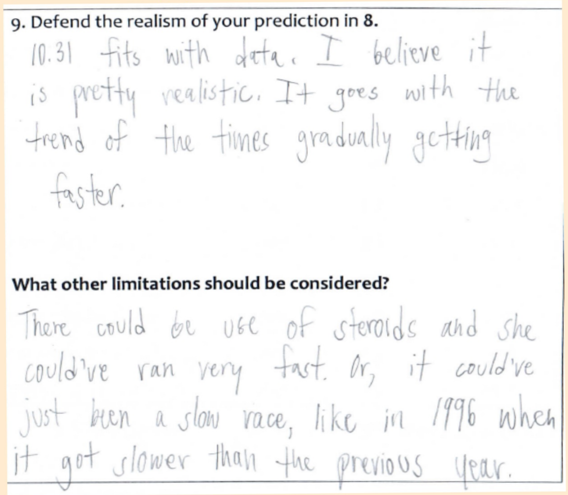
2020 is 120 years after 1900 so 120 = x

$$y = \frac{-2.1}{110}(120) + 12.6$$

$$\frac{-252}{110} + 12.6$$

$$-2.29 + 12.6 = \boxed{10.31 = \text{time in secs of medalist in 2020}}$$

Women's 100 m Olympic times



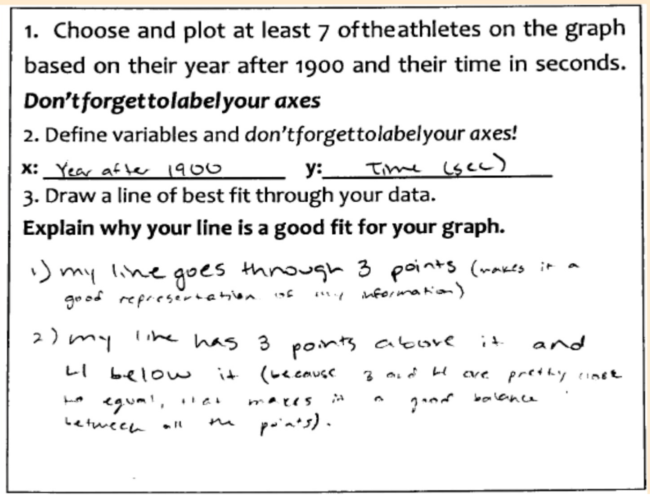
9. Defend the realism of your prediction in **8.**

10.31 fits with data. I believe it is pretty realistic. It goes with the trend of the times gradually getting faster.

What other limitations should be considered?

There could be use of steroids and she could've ran very fast. Or, it could've just been a slow race, like in 1996 when it got slower than the previous year.

Women's 100 m Olympic times



1. Choose and plot at least 7 oftheathletes on the graph based on their year after 1900 and their time in seconds.

Don'tforgettolabelyour axes

2. Define variables and *don'tforgettolabelyour axes!*

x: Year after 1900 **y:** Time (sec)

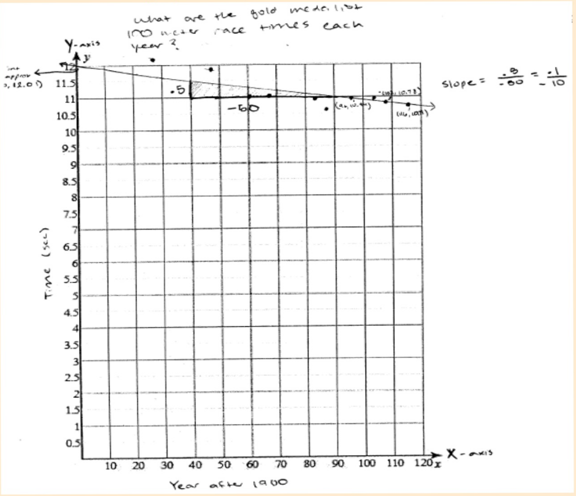
3. Draw a line of best fit through your data.

Explain why your line is a good fit for your graph.

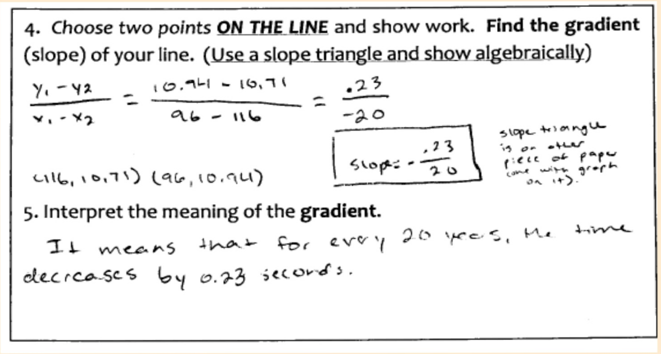
1) my line goes through 3 points (makes it a good representation of my information)

2) my line has 3 points above it and 4 below it (because 3 and 4 are pretty close to equal, that makes it a good balance between all the points).

Women's 100 m Olympic times



Women's 100 m Olympic times



4. *Choose two points* ***ON THE LINE*** and show work. **Find the gradient** (slope) of your line. (Use a slope triangle and show algebraically)

$$\frac{y_1 - y_2}{x_1 - x_2} = \frac{10.94 - 10.71}{96 - 116} = \frac{.23}{-20}$$

(116, 10.71) (96, 10.94)

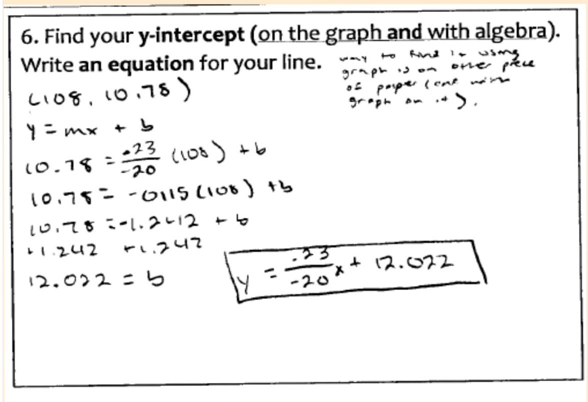
$$\boxed{\text{Slope} = -\frac{.23}{20}}$$

slope triangle is on other piece of paper (one with graph on it).

5. Interpret the meaning of the **gradient.**

It means that for every 20 years, the time decreases by 0.23 seconds.

Women's 100 m Olympic times



6. Find your **y-intercept** (on the graph **and** with algebra). Write **an equation** for your line.

way to find it using graph is on other piece of paper (one with graph on it).

(108, 10.78)

$y = mx + b$

$10.78 = \frac{.23}{-20}(108) + b$

$10.78 = -.0115(108) + b$

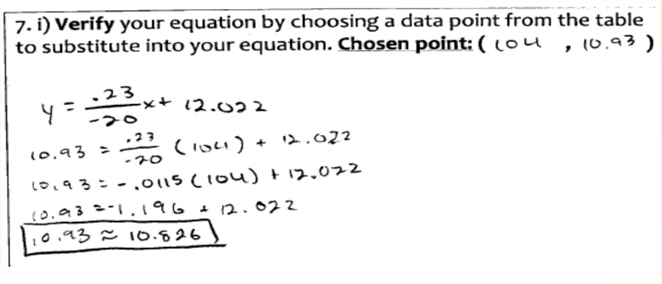
$10.78 = -1.2412 + b$

$+1.242 \quad +1.242$

$12.022 = b$

$$\boxed{y = \frac{.23}{-20}x + 12.022}$$

Women's 100 m Olympic times



7. i) Verify your equation by choosing a data point from the table to substitute into your equation. **Chosen point: (** 104 , 10.93 **)**

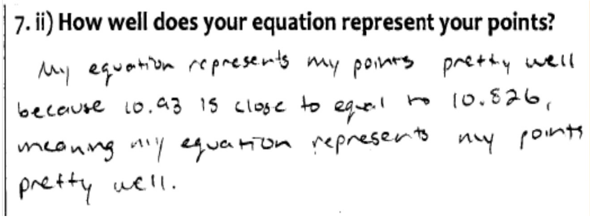
$$y = \frac{.23}{-20}x + 12.022$$

$$10.93 = \frac{.23}{-20}(104) + 12.022$$

$$10.93 = -.0115(104) + 12.022$$

$$10.93 = -1.196 + 12.022$$

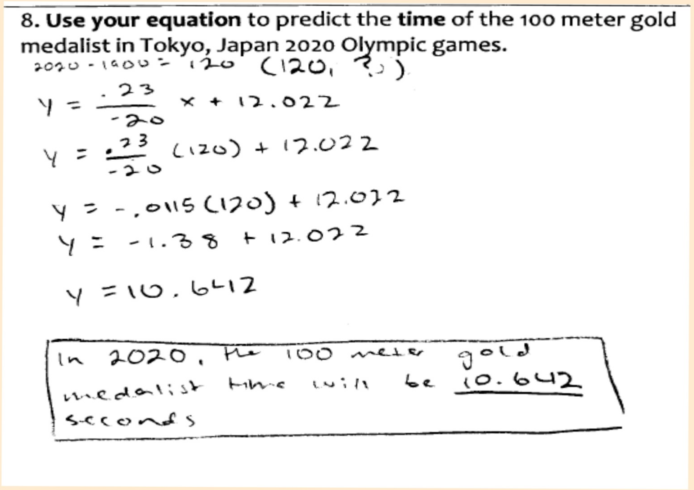
$$\boxed{10.93 \approx 10.826}$$



7. ii) How well does your equation represent your points?

My equation represents my points pretty well because 10.93 is close to equal to 10.826, meaning my equation represents my points pretty well.

Women's 100 m Olympic times



8. Use your equation to predict the **time** of the 100 meter gold medalist in Tokyo, Japan 2020 Olympic games.

2020 - 1900 = 120 (120, ?)

$$y = \frac{.23}{-20}x + 12.022$$

$$y = \frac{.23}{-20}(120) + 12.022$$

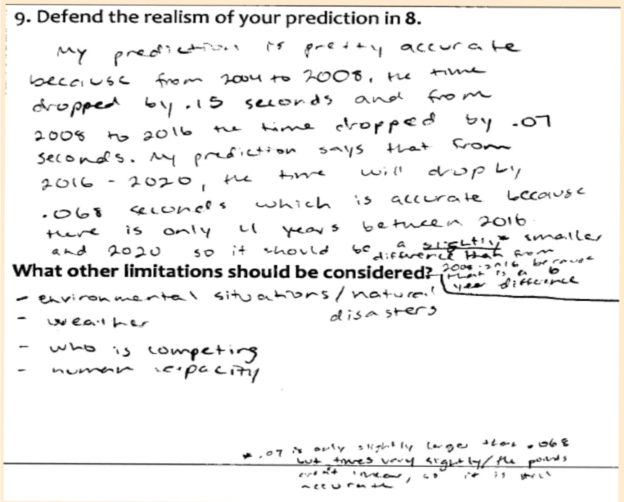
$$y = -.0115(120) + 12.022$$

$$y = -1.38 + 12.022$$

$$y = 10.642$$

In 2020, the 100 meter gold medalist time will be 10.642 seconds

Women's 100 m Olympic times



9. Defend the realism of your prediction in 8.

My prediction is pretty accurate because from 2004 to 2008, the time dropped by .15 seconds and from 2008 to 2016 the time dropped by .07 seconds. My prediction says that from 2016 - 2020, the time will drop by .068 seconds which is accurate because there is only 4 years between 2016 and 2020 so it should be a slightly* smaller difference than from 2008-2016 because that is a 6 year difference

What other limitations should be considered?

- environmental situations / natural disasters
- weather
- who is competing
- human capacity

*.07 is only slightly larger than .068 but times vary slightly / the points aren't linear, so it is still accurate

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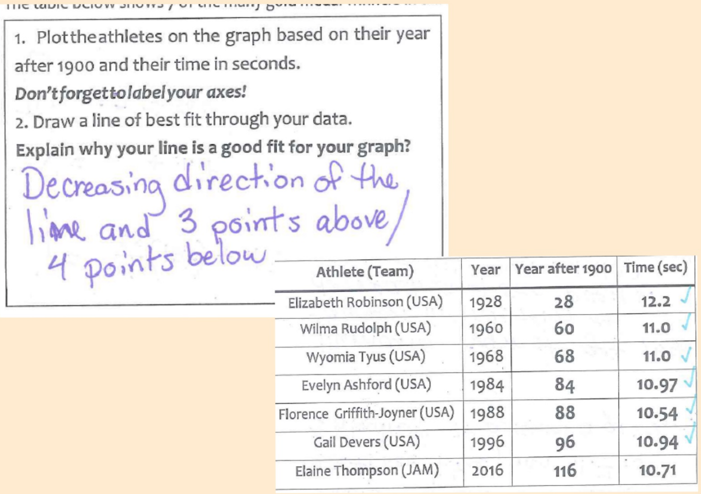
Women's 100 m Olympic times



1. Plot the athletes on the graph based on their year after 1900 and their time in seconds.

Don't forget to label your axes!

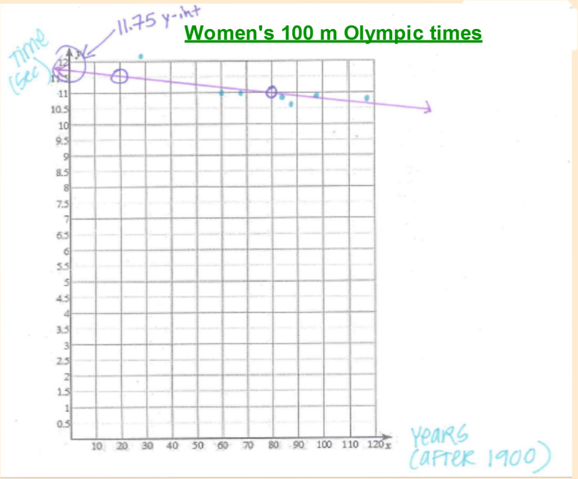
2. Draw a line of best fit through your data.

Explain why your line is a good fit for your graph?

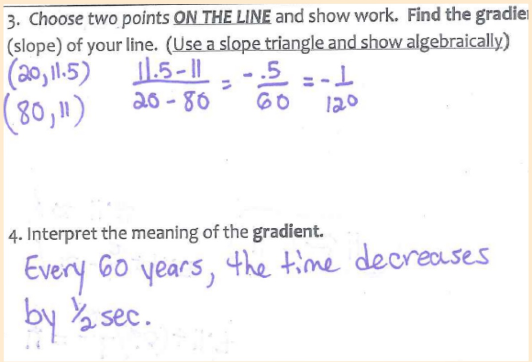
Decreasing direction of the line and 3 points above / 4 points below

Athlete (Team)	Year	Year after 1900	Time (sec)
Elizabeth Robinson (USA)	1928	28	12.2 ✓
Wilma Rudolph (USA)	1960	60	11.0 ✓
Wyomia Tyus (USA)	1968	68	11.0 ✓
Evelyn Ashford (USA)	1984	84	10.97 ✓
Florence Griffith-Joyner (USA)	1988	88	10.54 ✓
Gail Devers (USA)	1996	96	10.94 ✓
Elaine Thompson (JAM)	2016	116	10.71

Women's 100 m Olympic times



Women's 100 m Olympic times



3. *Choose two points **ON THE LINE*** and show work. **Find the gradie**
(slope) of your line. (Use a slope triangle and show algebraically)

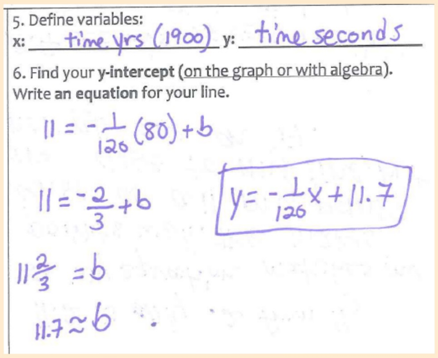
(20, 11.5)
(80, 11)

$\frac{11.5-11}{20-80} = -\frac{.5}{60} = -\frac{1}{120}$

4. Interpret the meaning of the **gradient.**

Every 60 years, the time decreases by ½ sec.

Women's 100 m Olympic times



5. Define variables:
x: time yrs (1900) y: time seconds

6. Find your **y-intercept** (on the graph or with algebra).
Write an **equation** for your line.

$11 = -\frac{1}{120}(80) + b$

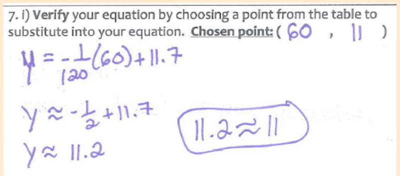
$11 = -\frac{2}{3} + b$

$11\frac{2}{3} = b$

$11.7 \approx b$

$\boxed{y = -\frac{1}{120}x + 11.7}$

Women's 100 m Olympic times



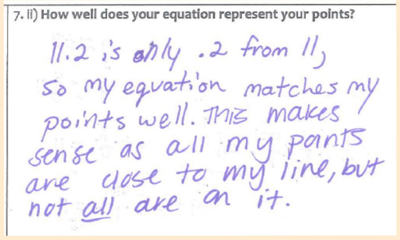
7. i) **Verify** your equation by choosing a point from the table to substitute into your equation. **Chosen point:** (60 , 11)

$y = -\frac{1}{120}(60) + 11.7$

$y \approx -\frac{1}{2} + 11.7$

$y \approx 11.2$

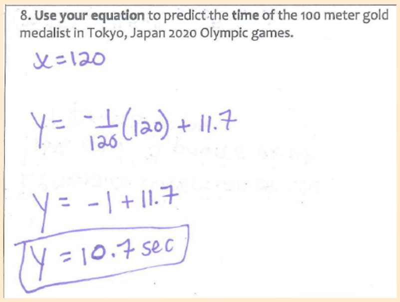
$11.2 \approx 11$



7. ii) **How well does your equation represent your points?**

11.2 is only .2 from 11, so my equation matches my points well. This makes sense as all my pants are close to my line, but not all are on it.

Women's 100 m Olympic times



8. **Use your equation** to predict the **time of** the 100 meter gold medalist in Tokyo, Japan 2020 Olympic games.

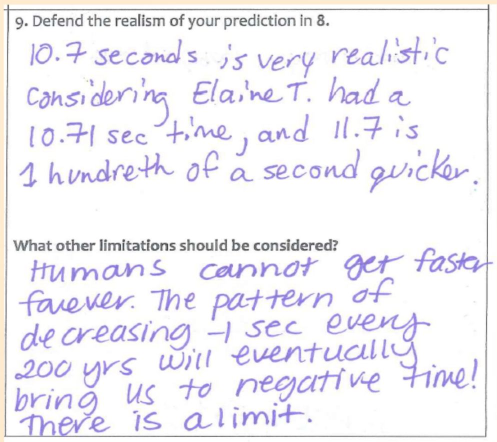
$x=120$

$y = -\frac{1}{120}(120) + 11.7$

$y = -1 + 11.7$

$\boxed{y = 10.7 \text{ sec}}$

Women's 100 m Olympic times



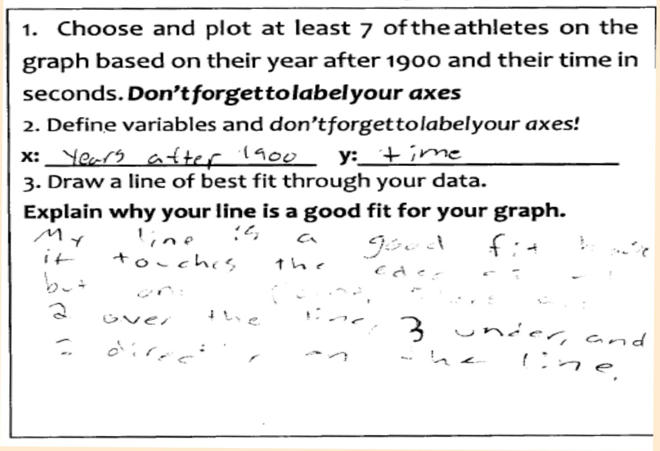
9. Defend the realism of your prediction in **8.**

10.7 seconds is very realistic considering Elaine T. had a 10.71 sec time, and 11.7 is 1 hundreth of a second quicker.

What other limitations should be considered?

Humans cannot get faster forever. The pattern of decreasing -1 sec every 200 yrs will eventually bring us to negative time! There is a limit.

Men's 100 m Olympic times



1. Choose and plot at least 7 of the athletes on the graph based on their year after 1900 and their time in seconds. ***Don't forget to label your axes***

2. Define variables and *don't forget to label your axes!*

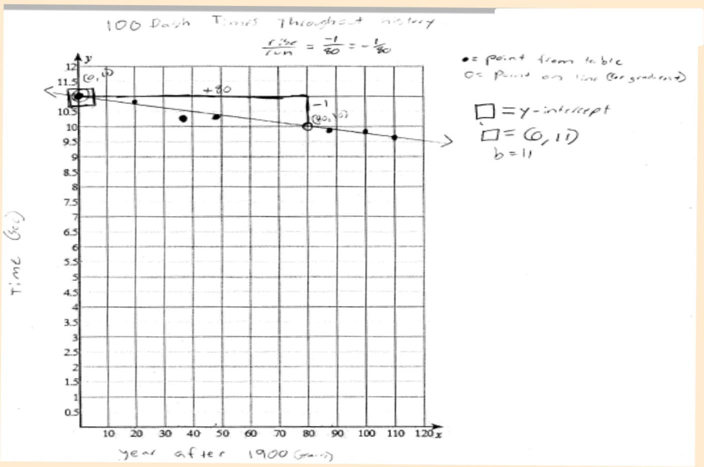
x: Years after 1900 y: time

3. Draw a line of best fit through your data.

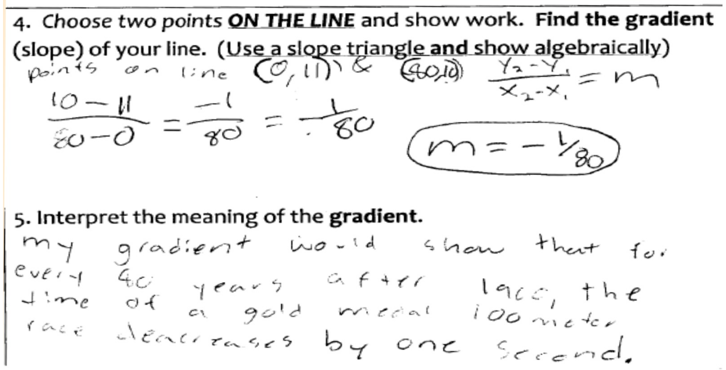
Explain why your line is a good fit for your graph.

My line is a good fit because it touches the edge of [illegible] but one [illegible], [illegible] 2 over the line, 3 under, and 2 directly on the line.

Men's 100 m Olympic times



Men's 100 m Olympic times



4. *Choose two points* ***ON THE LINE*** and show work. **Find the gradient** (slope) of your line. (Use a slope triangle **and** show algebraically)

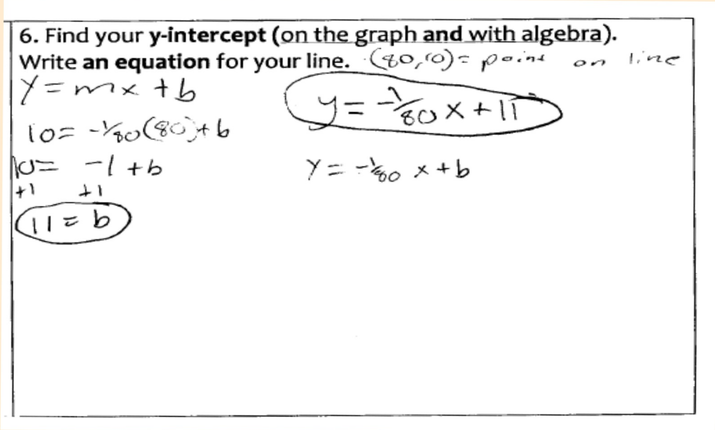
points on line (0, 11) & (80,10) $\frac{Y_2 - Y_1}{X_2 - X_1} = m$

$$\frac{10-11}{80-0} = \frac{-1}{80} = -\frac{1}{80} \qquad \boxed{m = -1/80}$$

5. Interpret the meaning of the **gradient**.

my gradient would show that for every 40 years after 1900, the time of a gold medal 100 meter race deacreases by one second.

Men's 100 m Olympic times



6. Find your **y-intercept** (on the graph **and** with algebra).
Write **an equation** for your line. (80,10) = point on line

$Y = mx + b$

$10 = -1/80(80) + b$

$10 = -1 + b$

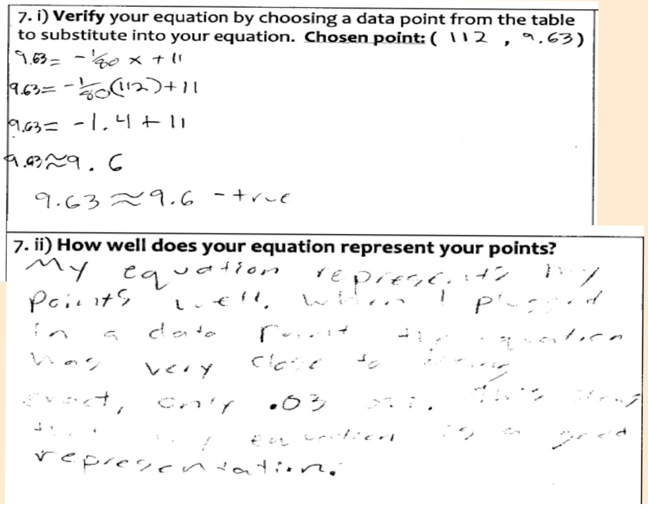
$+1 \quad +1$

$\boxed{11 = b}$

$\boxed{y = -\frac{1}{80}x + 11}$

$Y = -1/80\ x + b$

Men's 100 m Olympic times



7. i) Verify your equation by choosing a data point from the table to substitute into your equation. **Chosen point:** (112 , 9.63)

$9.63 = -\frac{1}{80}x + 11$

$9.63 = -\frac{1}{80}(112) + 11$

$9.63 = -1.4 + 11$

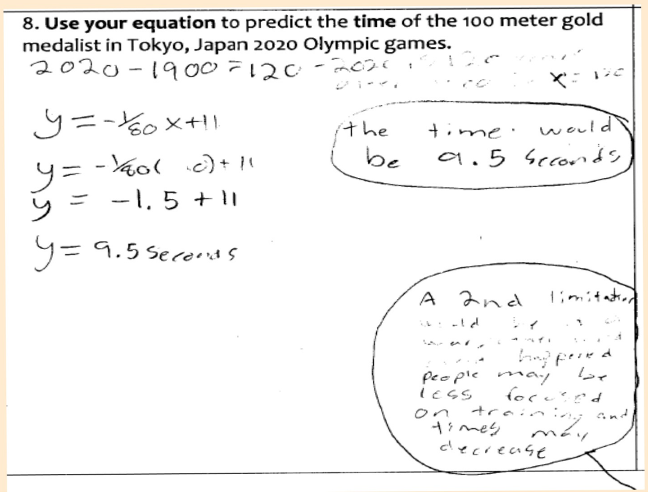
$9.63 \approx 9.6$

$9.63 \approx 9.6$ - true

7. ii) How well does your equation represent your points?

My equation represents my points well. When I plugged in a data point the equation was very close to being exact, only .03 off. This shows that my equation is a good representation.

Men's 100 m Olympic times



8. **Use your equation** to predict the **time** of the 100 meter gold medalist in Tokyo, Japan 2020 Olympic games.

2020 - 1900 = 120 - 2020 is 120 years [illegible] x = 120

$y = -\frac{1}{80}x + 11$

$y = -\frac{1}{80}(120) + 11$

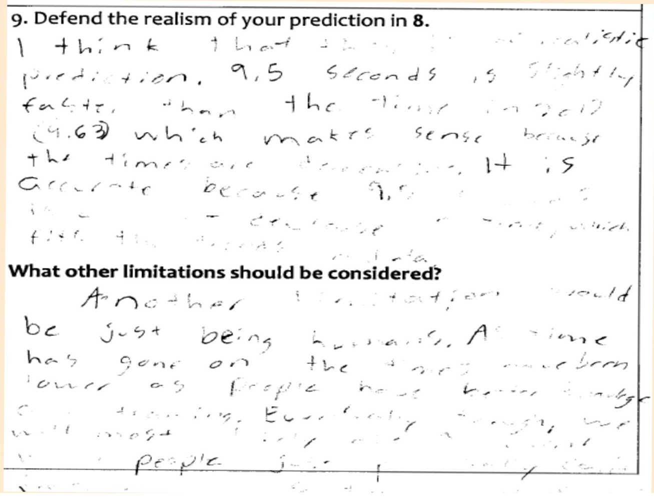
$y = -1.5 + 11$

$y = 9.5$ seconds

the time would be 9.5 seconds

A 2nd limitation would be if a war [illegible] happened people may be less focused on training and times may decrease

Men's 100 m Olympic times



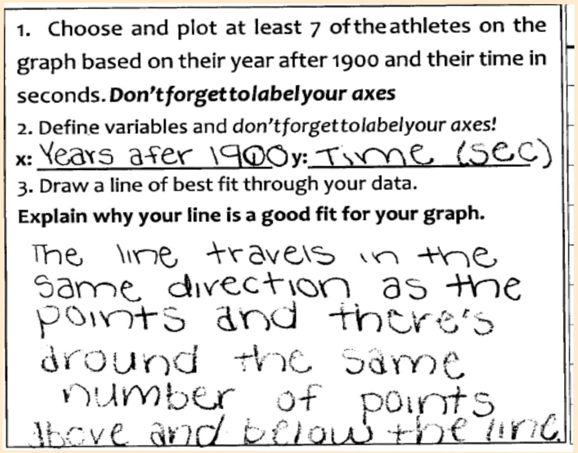
9. Defend the realism of your prediction in 8.

I think that this is a realistic prediction. 9.5 seconds is slightly faster than the time in 2012 (9.63) which makes sense because the times are decreasing. It is accurate because 9.5 [illegible] [illegible] [illegible] which fits the [illegible] in data

What other limitations should be considered?

Another limitation would be just being humans. As time has gone on the times have been lower as people have better knowledge of training. Eventually though, we will most likely [illegible] people just [illegible]

Men's 100 m Olympic times



1. Choose and plot at least 7 of the athletes on the graph based on their year after 1900 and their time in seconds. ***Don't forget to label your axes***

2. Define variables and *don't forget to label your axes!*

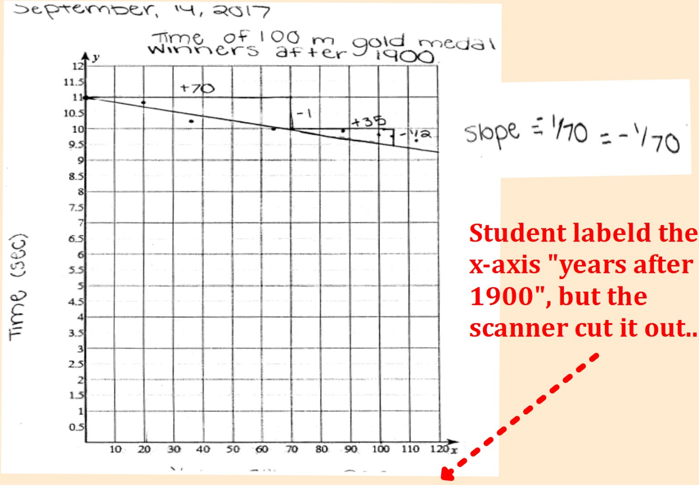
x: Years afer 1900 **y:** Time (sec)

3. Draw a line of best fit through your data.

Explain why your line is a good fit for your graph.

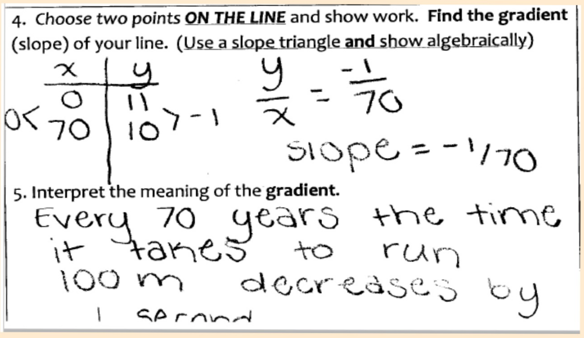
The line travels in the same direction as the points and there's around the same number of points above and below the line.

Men's 100 m Olympic times



Student labeld the x-axis "years after 1900", but the scanner cut it out...

Men's 100 m Olympic times



4. *Choose two points* ***ON THE LINE*** and show work. **Find the gradient** (slope) of your line. (Use a slope triangle **and** show algebraically)

	x	y	
0<	0	11	>-1
	70	10	

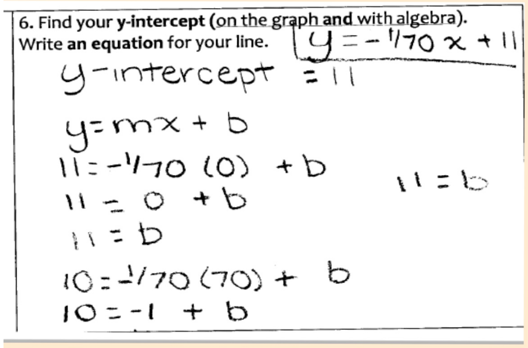
$\frac{y}{x} = \frac{-1}{70}$

slope = $-1/70$

5. Interpret the meaning of the **gradient**.

Every 70 years the time it takes to run 100 m decreases by 1 second

Men's 100 m Olympic times



6. Find your **y-intercept** (on the graph **and** with algebra). Write **an equation** for your line. $y = -1/70x + 11$

y-intercept $= 11$

$y = mx + b$

$11 = -1/70(0) + b$ $\qquad 11 = b$

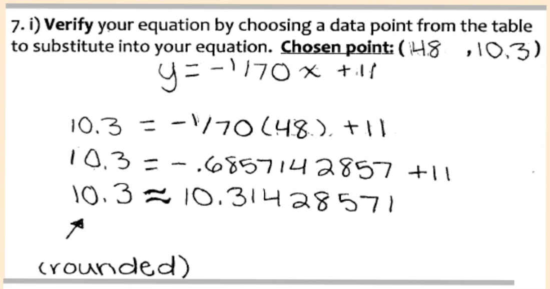
$11 = 0 + b$

$11 = b$

$10 = -1/70(70) + b$

$10 = -1 + b$

Men's 100 m Olympic times



7. i) **Verify** your equation by choosing a data point from the table to substitute into your equation. **Chosen point: (**48 , 10.3**)**

$y = -1/70x + 11$

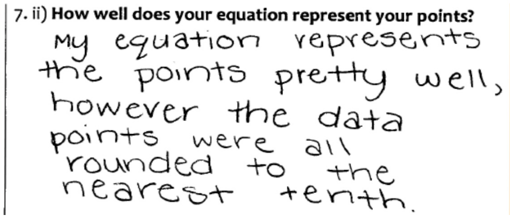
$10.3 = -1/70(48.). + 11$

$10.3 = -.6857142857 + 11$

$10.3 \approx 10.31428571$

↗

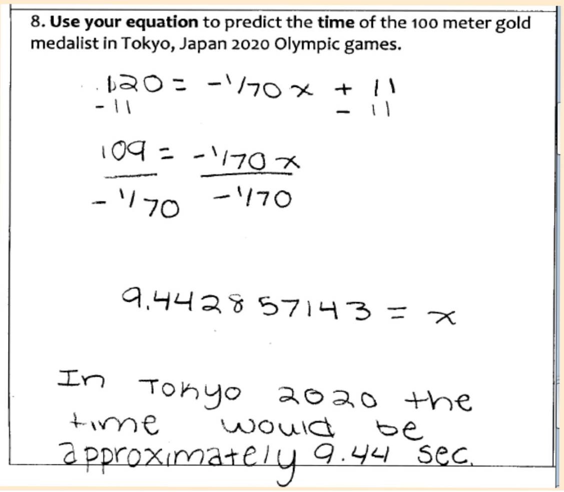
(rounded)



7. ii) **How well does your equation represent your points?**

My equation represents the points pretty well, however the data points were all rounded to the nearest tenth.

Men's 100 m Olympic times



8. **Use your equation** to predict the **time** of the 100 meter gold medalist in Tokyo, Japan 2020 Olympic games.

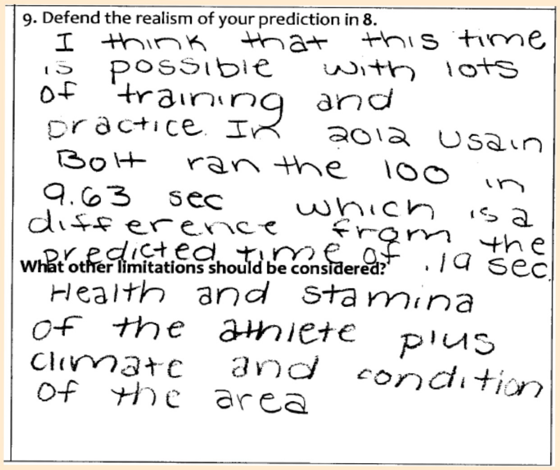
$$120 = -1/70x + 11$$
$$-11 \qquad\qquad -11$$

$$\frac{109}{-1/70} = \frac{-1/70x}{-1/70}$$

$$9.442857143 = x$$

In Tokyo 2020 the time would be approximately 9.44 sec.

Men's 100 m Olympic times



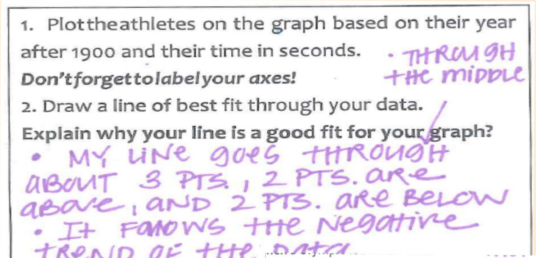
9. Defend the realism of your prediction in **8.**

I think that this time is possible with lots of training and practice. In 2012 Usain Bolt ran the 100 in 9.63 sec which is a difference from the predicted time of .19 sec.

What other limitations should be considered?

Health and stamina of the athlete plus climate and condition of the area

Men's 100 m Olympic times



1. Plot the athletes on the graph based on their year after 1900 and their time in seconds. **_Don't forget to label your axes!_**

   • THROUGH THE MIDDLE

2. Draw a line of best fit through your data.

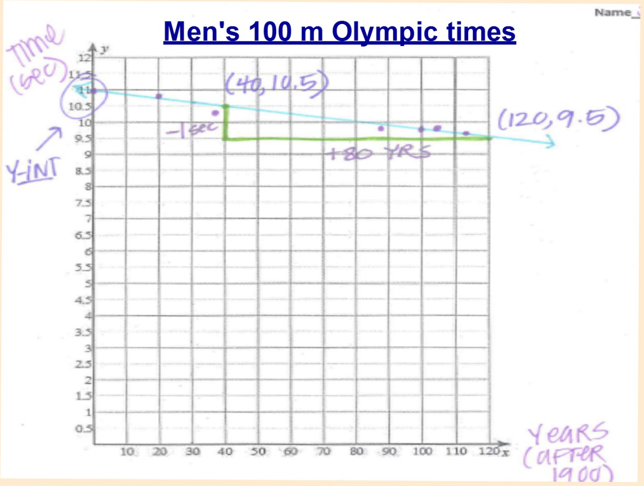
   Explain why your line is a good fit for your graph?

   • MY LINE GOES THROUGH ABOUT 3 PTS., 2 PTS. ARE ABOVE, AND 2 PTS. ARE BELOW

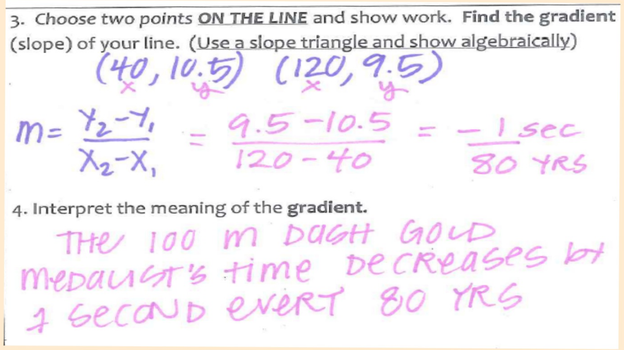
   • IT FOLLOWS THE NEGATIVE TREND OF THE DATA

Athlete (Team)	Year	Year after 1900	Time (sec)
Frank Jarvis (USA)	1900	0	11.0
Charles Paddock (USA)	1920	20	10.8
Jesse Owens (USA)	1936	36	10.3
Carl Lewis (USA)	1988	88	9.92
Maurice Greene (USA)	2000	100	9.87
Justin Gatlin (USA)	2004	104	9.85
Usain Bolt (JAM)	2012	112	9.63

Men's 100 m Olympic times



Men's 100 m Olympic times



3. *Choose two points* **ON THE LINE** and show work. **Find the gradient** (slope) of your line. (Use a slope triangle and show algebraically)

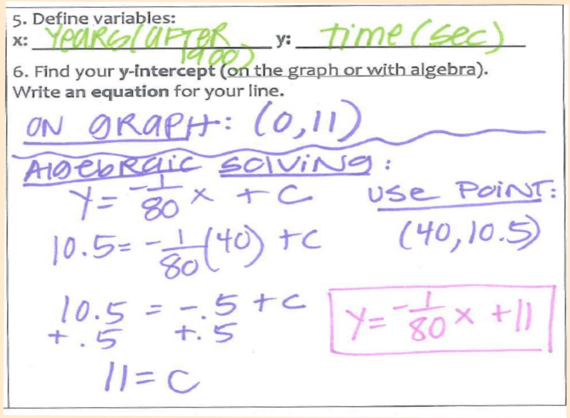
$(\underset{x}{40}, \underset{y}{10.5})$ $(\underset{x}{120}, \underset{y}{9.5})$

$$m = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{9.5 - 10.5}{120 - 40} = \frac{-1 \text{ sec}}{80 \text{ YRS}}$$

4. Interpret the meaning of the **gradient.**

THE 100 m DASH GOLD MEDALIST'S time DECREASES BY 1 SECOND EVERY 80 YRS

Men's 100 m Olympic times



5. Define variables:

x: YEARS (AFTER 1900) y: time (sec)

6. Find your **y-intercept** (on the graph or with algebra). Write an **equation** for your line.

ON GRAPH: (0,11)

ALGEBRAIC SOLVING:

$Y = \frac{-1}{80}x + C$ USE POINT: (40,10.5)

$10.5 = -\frac{1}{80}(40) + c$

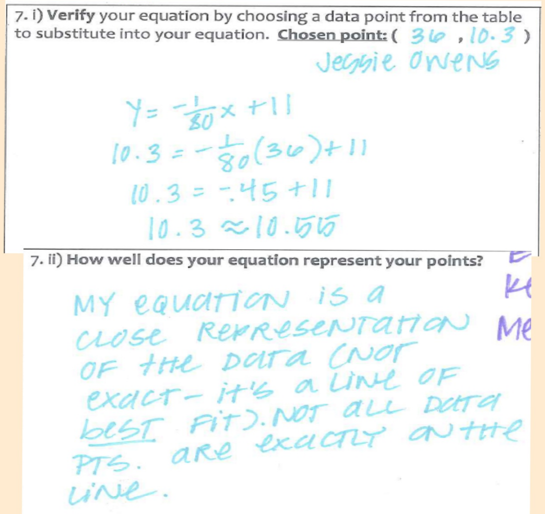
$10.5 = -.5 + c$

$+.5 \quad +.5$

$11 = c$

$$\boxed{Y = \frac{-1}{80}x + 11}$$

Men's 100 m Olympic times



7. i) **Verify** your equation by choosing a data point from the table to substitute into your equation. **Chosen point:** (36 , 10.3)

Jessie Owens

$$Y = -\frac{1}{80}x + 11$$

$$10.3 = -\frac{1}{80}(36) + 11$$

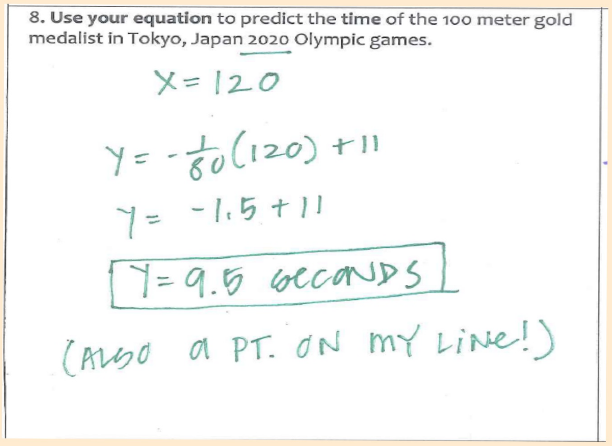
$$10.3 = -.45 + 11$$

$$10.3 \approx 10.55$$

7. ii) **How well does your equation represent your points?**

MY equation is a close representation of the data (not exact - it's a line of <u>best</u> fit). Not all data pts. are exactly on the line.

Men's 100 m Olympic times



8. **Use your equation** to predict the **time** of the 100 meter gold medalist in Tokyo, Japan 2020 Olympic games.

$$X = 120$$

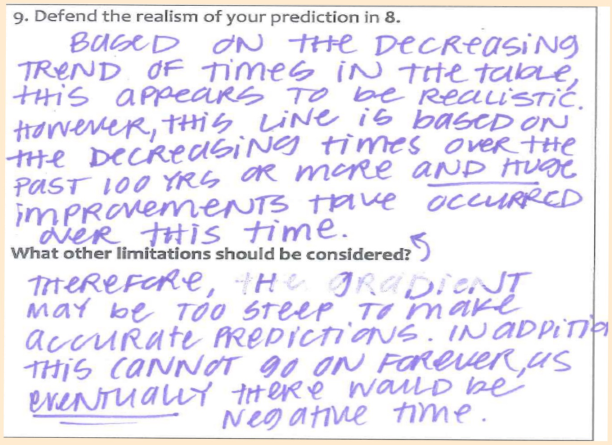
$$Y = -\frac{1}{80}(120) + 11$$

$$Y = -1.5 + 11$$

$$\boxed{Y = 9.5 \text{ seconds}}$$

(Also a pt. on my line!)

Men's 100 m Olympic times



9. Defend the realism of your prediction in 8.

BASED ON THE DECREASING TREND OF TIMES IN THE TABLE, THIS APPEARS TO BE REALISTIC. HOWEVER, THIS LINE IS BASED ON THE DECREASING TIMES OVER THE PAST 100 YRS OR MORE AND HUGE IMPROVEMENTS HAVE OCCURRED OVER THIS TIME.

What other limitations should be considered?

THEREFORE, THE GRADIENT MAY BE TOO STEEP TO MAKE ACCURATE PREDICTIONS. IN ADDITIO THIS CANNOT GO ON FOREVER, AS EVENTUALLY THERE WOULD BE NEGATIVE TIME.