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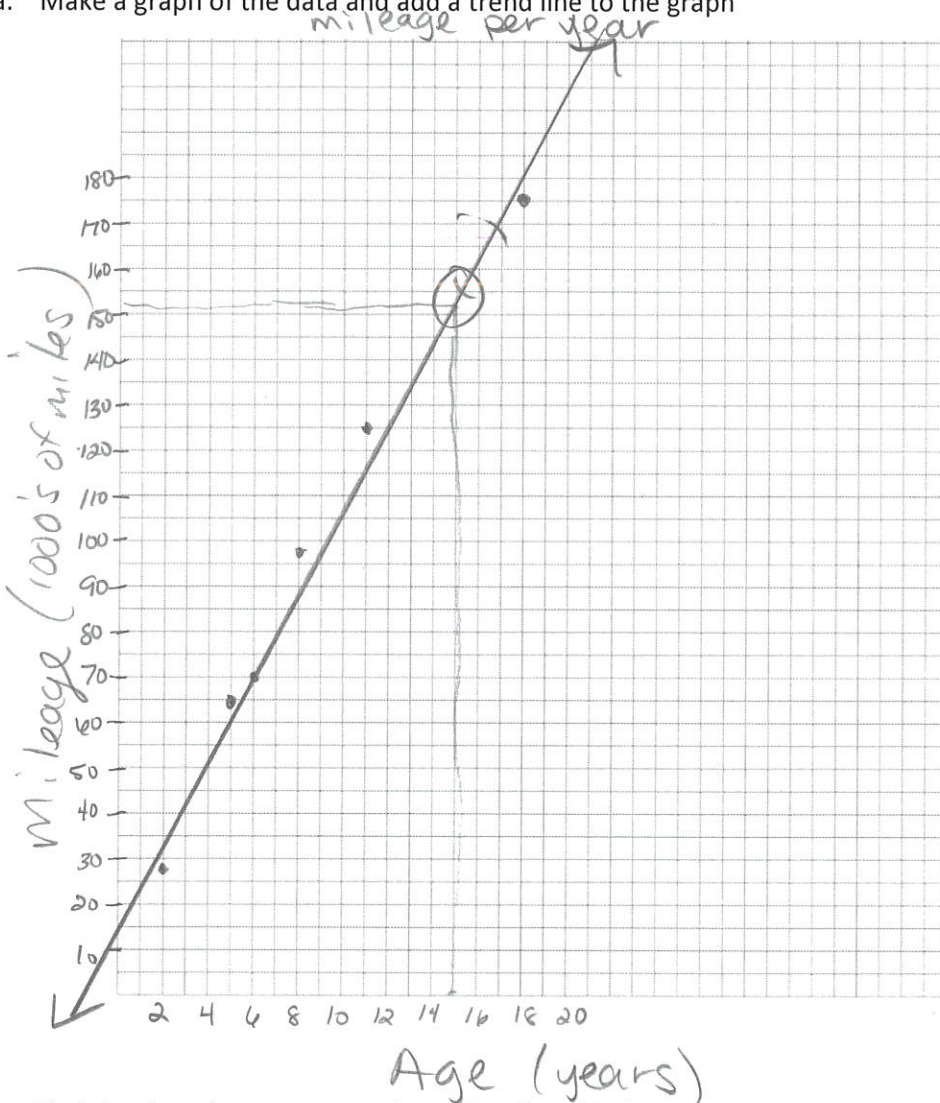
Math 96 Semester 1 Final Study Guide

Justify and show the means by which you arrive at your answers for full credit.

- Place a **box** around your final answer.
- Answers must be labeled for full credit.

Age (years)	Mileage (1000's of miles)
2	28
5	65
6	70
8	98
11	125
18	175

- Consider the data for the mileage of a car:
 - Make a graph of the data and add a trend line to the graph



- Find the slope between years 2 and 6 and explain its meaning in context in a complete sentence.

$(2, 28) \quad (6, 70)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{70 - 28}{6 - 2} = \frac{42}{4} \approx 10.5$$

The mileage goes of 10.5 thousand miles per year.

- Use your trend line to estimate the mileage at year 15.

≈ 152 thousand miles
 152,000

2. Svetlana collected data as to how the number of hours she exercised each week affected her heart rate in beats per minute (BPM).

Hours of Exercise	Heart Rate (BPM)
2	110
5	98
8	88
12	80
18	68

Round slopes and y-intercepts to 2 decimal places

- a. Find the equation of the line passing through (2,110) and (12, 80).

$$m = \frac{80 - 110}{12 - 2} = -\frac{30}{10} = -3$$

$$m = -3$$

$$y = mx + b$$

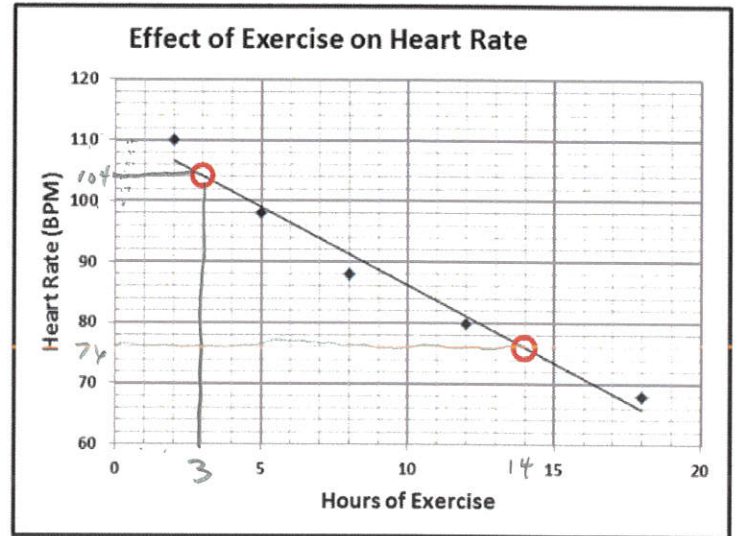
$$80 = -3(12) + b$$

$$80 = -36 + b$$

$$+36 \quad +36$$

$$116 = b$$

$$y = -3x + 116$$



- b. Find the equation of the line through the two representative points circled on the trend line.

$$(3, 104) \quad (14, 76)$$

$$m = \frac{76 - 104}{14 - 3} = -\frac{28}{11} = -2.545$$

$$m = -2.55$$

$$76 = -2.55(14) + b$$

$$76 = -35.7 + b$$

$$+35.7 \quad +35.7$$

$$111.7 = b$$

$$y = -2.55x + 111.7$$

- c. Use your equation from (b) to predict her heart rate if she exercises 6 hours per week.

$$x = 6$$

$$y = -2.55(6) + 111.7$$

$$= -15.3 + 111.7 = 96.4 \text{ BPM}$$

- d. Explain the meaning of the slope from (b) in a complete sentence.

For every hour of exercise your heart beat goes down 2.55 beats per minute.

- e. Explain the meaning of the y-intercept from (b) in a complete sentence.

With zero hours of exercise her heart rate is 111.7 beats per minute.

3. Reconsider the data from question 2.

Hours of Exercise	Heart Rate (BPM)
2	110
5	98
8	88
12	80
18	68

Round slopes and y-intercepts to 3 decimal places

- a. Find the equation for the trend line using the regression feature of your graphing calculator. Stat Edit Stat Calc

$$a = -2.551282051$$

$$b = 111.7615385$$

$$y = -2.551x + 111.762$$

- b. Use your regression equation to predict her heart rate if she exercises 10 hours per week.

$$x = 10$$

$$y = -2.551(10) + 111.762$$

$$= -25.51 + 111.762$$

$$y = 86.252 \text{ BPM}$$

- c. Use your regression equation to calculate the number of hours she would have to exercise to get her heart rate to 60 BPM.

$$y = 60$$

$$60 = -2.551x + 111.762$$

$$-111.762 \quad -111.762$$

$$\frac{-51.762}{-2.551} = \frac{-2.551x}{-2.551}$$

$$x = 20.29084633$$

$$x = 20.291 \text{ hours}$$

4. The equation $C = 0.012G + 7$ models the Cost (C) in dollars as a function of the gallons (G) used in a home. Find the gallons used for a customer who received a bill for \$21.84 (round to the nearest gallon).

$$C = 21.84$$

$$21.84 = 0.012G + 7$$

$$-7 \quad -7$$

$$\frac{14.84}{0.012} = \frac{0.012G}{0.012}$$

$$G = 1236.666\dots$$

$$G = 1237 \text{ gallons}$$

The customer used about 1237 gallons.

Highest power to Lowest power

Rewrite each polynomial in Standard form. Then name each polynomial by degree and number of terms

5. ~~$5x^3 + 2x^2 - 3x^2 + 4x + 5x^3 - 16$~~

$$10x^3 - x^2 + 4x - 16$$

Cubic

4 terms

6. ~~$3x - 6 + 5x^2 + 2x - 12 - 2x^2$~~

$$3x^2 + 5x - 18$$

Quadratic

Trinomial

1 monomial

2 binomial

3 trinomial

4 ↑ 4 terms

5 terms

⋮

⋮

⋮

0 ^{degree} Constant

1 Linear

2 Quadratic

3 Cubic

4 Quartic

5 Quintic

6 ↑ 6th degree

7th degree

,

⋮

Perform the indicated operation and write the result in Standard Form.

7. ~~$(2x + 3x^4 - 4x^3 + 6x^2 - 10) + (2x^2 - 4x + 6)$~~

$$3x^4 - 4x^3 + 8x^2 - 2x - 4$$

8. $(4x^3 - 2x + 4) - (3x^3 - 4x^2 + 6x - 2)$

~~$$4x^3 - 2x + 4 - 3x^3 + 4x^2 - 6x + 2$$~~

$$x^3 + 4x^2 - 8x + 6$$

Perform the indicated operation and write the result in Standard Form.

9. $(x-5)^2$

$$(x-5)(x-5) = x^2 - 5x - 5x + 25$$
$$= x^2 - 10x + 25$$

10. $2x(3x^2 - 2x)(2x - 3)$

$$(6x^3 - 4x^2)(2x - 3) = 12x^4 - 18x^3 - 8x^3 + 12x^2$$
$$= 12x^4 - 26x^3 + 12x^2$$

11. $(x^2 - 3x + 2)(3x^2 + 2x - 2)$

$$3x^4 + 2x^3 - 2x^2 - 9x^3 - 6x^2 + 6x + 6x^2 + 4x - 4$$
$$= 3x^4 - 7x^3 - 2x^2 + 10x - 4$$

Solve each equation using the zero product property

12. $(y+2)(y-5)=0$

$$y+2=0 \quad y-5=0$$
$$\begin{array}{cc} -2 & -2 \\ +5 & +5 \end{array}$$

$$y = -2 \quad y = 5$$

13. $a(a+5)=0$

$$a=0 \quad a+5=0$$
$$\begin{array}{cc} -5 & -5 \end{array}$$

$$a = -5$$

Solve each equation using square roots

14. $9x^2 = 81$

$$\frac{9x^2}{9} = \frac{81}{9} \quad \sqrt{x^2} = \sqrt{9}$$

$$x = \pm 3$$

15. $25x^2 - 125 = 0$

$$\begin{array}{r} +125 +125 \\ \hline 25x^2 = 125 \\ \hline \frac{25x^2}{25} = \frac{125}{25} \end{array}$$

$$\sqrt{x^2} = \sqrt{5} \quad x = \pm \sqrt{5}$$

Solve each equation by factoring must be equal to zero

16. $a^2 + 6a = 16$

$$\begin{array}{r} -16 -16 \\ \hline a^2 + 6a - 16 = 0 \\ (a + 8)(a - 2) = 0 \end{array}$$

$$\begin{array}{r} 1 \quad 16 \\ 2 \quad 8 \\ 4 \quad 4 \end{array}$$

$$\begin{array}{r} a + 8 = 0 \\ -8 \quad -8 \\ a - 2 = 0 \\ +2 \quad +2 \end{array}$$

$$a = -8 \quad a = 2$$

17. $2y^2 = 6y + 56$

$$\begin{array}{r} -6y - 56 \quad -6y - 56 \\ \hline 2y^2 - 6y - 56 = 0 \\ \hline \frac{2y^2}{2} - \frac{6y}{2} - \frac{56}{2} = \frac{0}{2} \end{array}$$

$$\begin{array}{r} y^2 - 3y - 28 = 0 \\ (y - 7)(y + 4) = 0 \end{array}$$

$$\begin{array}{r} y - 7 = 0 \\ +7 \quad +7 \\ y + 4 = 0 \\ -4 \quad -4 \end{array}$$

$$y = 7 \quad y = -4$$

Solve each equation using the quadratic formula

18. $2x^2 + 3x - 20 = 0$

$$\begin{array}{l} a = 2 \\ b = 3 \\ c = -20 \end{array}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-3 \pm \sqrt{3^2 - 4 \cdot 2 \cdot (-20)}}{2 \cdot 2} = \frac{-3 \pm \sqrt{9 + 160}}{4} = \frac{-3 \pm \sqrt{169}}{4} = \frac{-3 \pm 13}{4}$$

$$x = \frac{-3 + 13}{4} = \frac{10}{4} = \frac{5}{2} \quad x = \frac{-3 - 13}{4} = \frac{-16}{4} = -4$$

19. $4x^2 + 10x + 2 = 0$ $a = 4$ $b = 10$ $c = 2$

$$x = \frac{-10 \pm \sqrt{10^2 - 4 \cdot 4 \cdot 2}}{2 \cdot 4} = \frac{-10 \pm \sqrt{100 - 32}}{8} = \frac{-10 \pm \sqrt{68}}{8}$$

$$= \frac{-10 \pm 2\sqrt{17}}{8 \div 2} = \frac{-5 \pm \sqrt{17}}{4}$$

$$x = \frac{-b}{2a}$$

Graph each equation making sure to find the axis of symmetry and vertex, the y-intercept, and the zeros.

20. $y = x^2 - 2x - 3$ $ax^2 + bx + c$

$$x = \frac{-(-2)}{2(1)} = \frac{2}{2} = 1$$

$$y = 1^2 - 2(1) - 3 \quad (1, -4)$$

$$y = 1 - 2 - 3$$

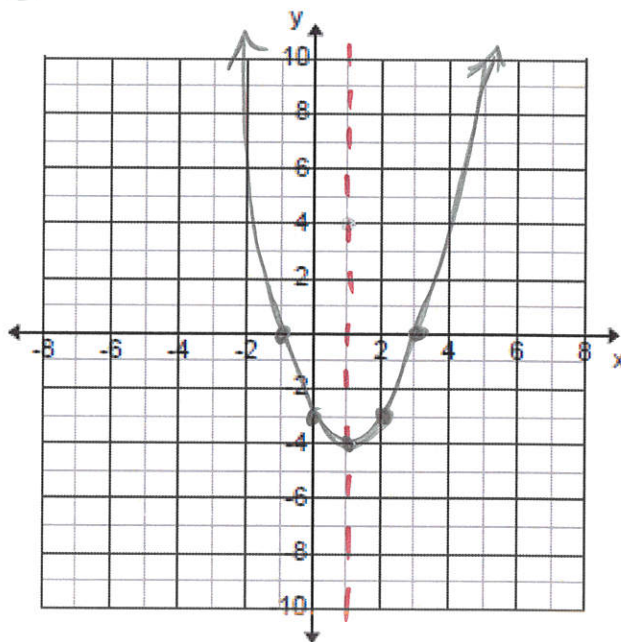
$$y = -4$$

$$(0, c) \Rightarrow (0, -3)$$

$$x^2 - 2x - 3 = 0$$

$$(x + 1)(x - 3) = 0$$

$x + 1 = 0$	$x - 3 = 0$
$-1 \quad -1$	$+3 \quad +3$
<hr style="width: 50px; margin: 0 auto;"/>	
$x = -1$	$x = 3$
$(-1, 0)$	$(3, 0)$



21. $y = -x^2 + 3x + 4$

$$x = \frac{-3}{2(-1)} = \frac{-3}{-2} = 1.5$$

$$y = -(1.5)^2 + 3(1.5) + 4$$

$$y = -2.25 + 4.5 + 4$$

$$y = 6.25 \quad (1.5, 6.25)$$

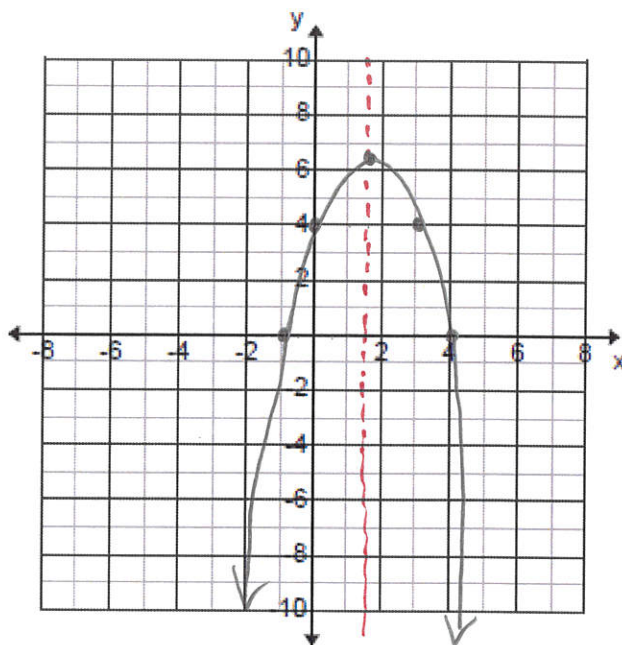
$$(0, c) \Rightarrow (0, 4)$$

pick a point and plug it in. $x = 4$

$$y = -(4^2) + 3 \cdot 4 + 4$$

$$y = -16 + 12 + 4$$

$$y = 0$$



22. A rocket carrying fireworks is launched from a hill 80 feet above a lake. The rocket will fall into lake after exploding at its maximum height. The rocket's height above the surface of the lake is given by $h(t) = -16t^2 + 64t + 80$. How long will it take for the rocket to explode and what will the height be when it explodes? Find vertex

$$x = \frac{-b}{2a} = \frac{-64}{2(-16)} = \frac{-64}{-32} = \boxed{2 \text{ sec}}$$

$$h(2) = -16(2)^2 + 64 \cdot 2 + 80 \quad (2, 144)$$

$$h(2) = -16 \cdot 4 + 128 + 80$$

$$h(2) = -64 + 128 + 8$$

$$\boxed{h(2) = 144 \text{ ft}}$$

It will take 2 seconds for the rocket to explode and it will be at a height of 144 feet.

23. A rock is thrown from the top of a tall building. The distance, in feet, between the rock and the ground t seconds after it is thrown is given by $d(t) = -16t^2 - 4t + 382$. How long after the rock is thrown is it 370 feet from the ground? Find when $d(t) = 370$

$$\frac{-16t^2 - 4t + 382 = 370}{-370 \quad -370}$$

$$\frac{-16t^2 - 4t + 12 = 0}{-4 \quad -4 \quad -4 \quad -4}$$

$$4t^2 + t - 3 = 0$$

Factor or use
Quadratic formula

$$x = \frac{-1 \pm \sqrt{(1)^2 - 4(1)(-3)}}{2 \cdot 4}$$

$$x = \frac{-1 \pm \sqrt{1+12}}{8}$$

$$x = \frac{-1 \pm \sqrt{13}}{8}$$

$$x = \frac{-1 + \sqrt{13}}{8} \quad \text{or} \quad x = \frac{-1 - \sqrt{13}}{8}$$

$$* \boxed{x \approx 0.3256939094} \quad \text{or} \quad x \approx -0.5156939094$$

* It will take about 0.3 seconds for the rock to reach 370 ft

24. A ball is thrown upward from a height of 15 ft. with an initial upward velocity of 5 ft/s. Use the formula $h(t) = -16t^2 + 5t + 15$ to find how long it will take for the ball to hit the ground. = 0 Time cannot be negative
Find the zero's use Factoring or Quadratic Formula

$$x = \frac{-5 \pm \sqrt{5^2 - 4(-16) \cdot 15}}{2 \cdot (-16)}$$

$$x = \frac{-5 \pm \sqrt{25 + 960}}{-32}$$

$$x = \frac{-5 \pm \sqrt{985}}{-32}$$

$$x = \frac{-5 + \sqrt{985}}{-32} \quad \text{or}$$

$$x = \frac{-5 - \sqrt{985}}{-32}$$

$$x \approx -0.8245221767$$

Time is never negative

$$\boxed{x \approx 1.137022177}$$

It will take about 1.14 seconds for the ball to hit the ground