Grade 9

LINEAR RELATIONS: GRAPHING AND ANALYZING

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Answers:

1. a. linear   b. linear   c. nonlinear   d. nonlinear   e. linear   f. linear

2. a. linear

x	y	Δy
2	4	$9-4=5$
3	9	
4	14	$14-9=5$
5	19	$19-14=5$
6	24	$24-19=5$

b. nonlinear

x	y	Δy
2	4	$9-4=5$
3	9	
4	16	$16-9=7$
5	25	$25-16=9$
6	36	$36-25=11$

c. linear

x	y	Δy
5	-3	$-2-(-3)=1$
4	-2	
3	-1	$-1-(-2)=1$
2	0	$0-(-1)=1$
1	1	$1-0=1$

3.   a.
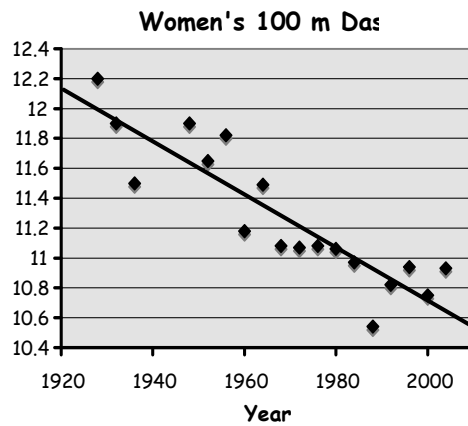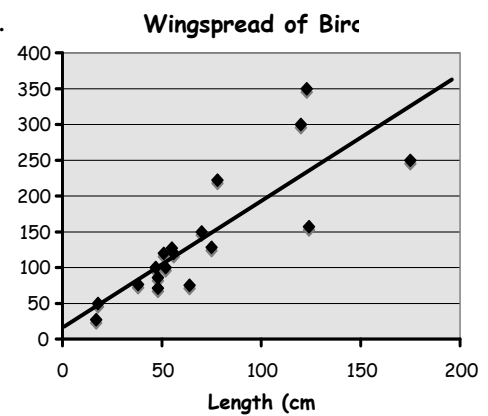
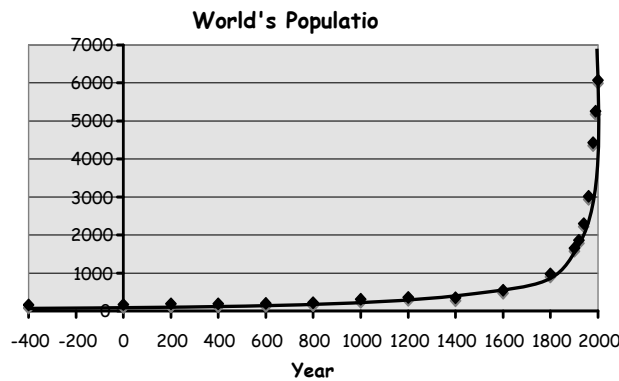Women's 100 m Dash

b.

Wingspread of Bird

c.

World's Population

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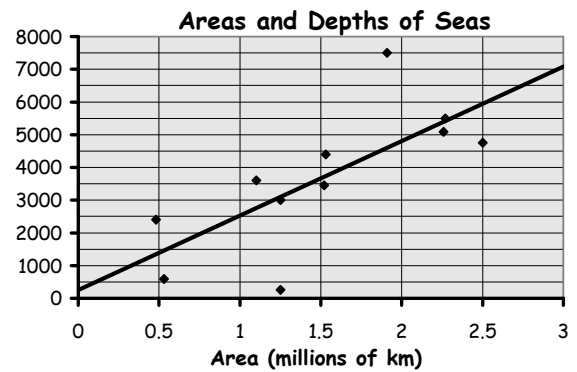
4. a.

Year	Time (s)
1968	68.1
1972	65.89
1976	63.88
1984	62.16
1992	61.5
1996	60.6
2000	60.46

Men's 100 meter Breaststrol
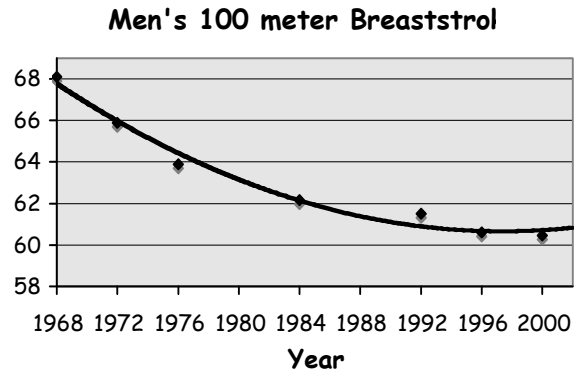
b.

Area (milions of km^2)	Depth (m)
0.48	2400
0.53	590
1.1	3600
1.25	250
1.25	3000
1.52	3450
1.53	4400

Areas and Depths of Seas

5. a. Point A represents a mark of 74 for a student who studied for three hours.

    c. Yes, there is a strong relationship between hours of study and the marks. The data points are all fairly close to the curve of best fit to indicate the strength of the relationship.
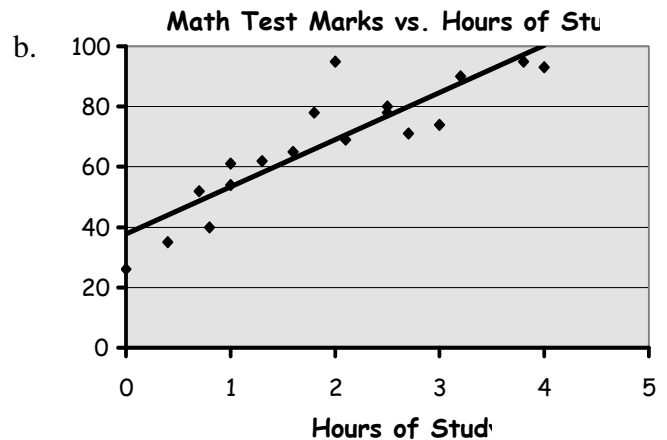
    b. **Math Test Marks vs. Hours of Stu**

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6.   a.

Age	Number of Coins Received	
	Alexander	**Cleopatra**
0	0	18
1	4	21
2	8	24
3	12	27
4	16	30
5	20	33
6	24	36
7	28	39
8	32	42
9	36	45
10	40	48
11	44	51
12	48	54
13	52	57
14	56	60
15	60	63

At birth


Number of Coins Recived

◆ Alexander   ▲ Cleopatra
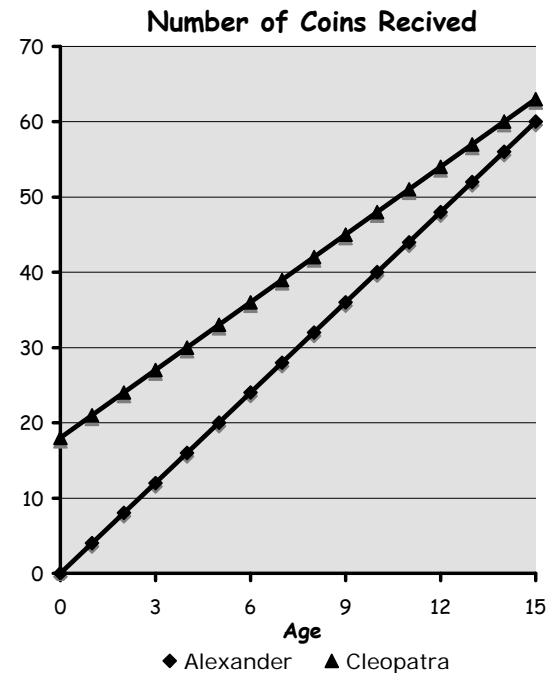
b.   To create an equation for the line of best fit for each set of data:
let a and c represent the age and the number of coins respectively.
Alexander: $c = 4a$, $0 \le a \le 15$ Cleopatra: $c = 3a + 18$, $0 \le a \le 15$

c.   To determine the age at which Alexander and Cleopatra will have the same number of coins, equate the expression for the number of coins they each receive, $4a = 3a + 18$ and solve for a. $a = 18$.
At the age of 18 Alexander and Cleopatra will have received the same number of coins.

d.   Alexander: $c = 4(25)$ Cleopatra: $c = 3(25) + 18$
                   $c = 100$ $c = 93$
Alexander would have 7 more coins then Cleopatra.

e.   If Cleopatra receives 30 coins at birth, the new expression for the number of coins she receives would be: $c = 3a + 30$.
At the age of 21, they would have received,
Alexander: $c = 4(21)$ Cleopatra: $c = 3(21) + 30$
                   $c = 84$ $c = 93$
Cleopatra would receive nine more coins then Alexander.

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7. a. The scatter plot shows a linear relationship between the side length and perimeter of an equilateral triangle. The equation of the curve of best fit for this scatter plot is $y = 3x$.

    b. i. $y = 3(12) = 36$
        ii. $y = 3(45) = 135$

Equilateral Triangle

8. a.

Apples Picked
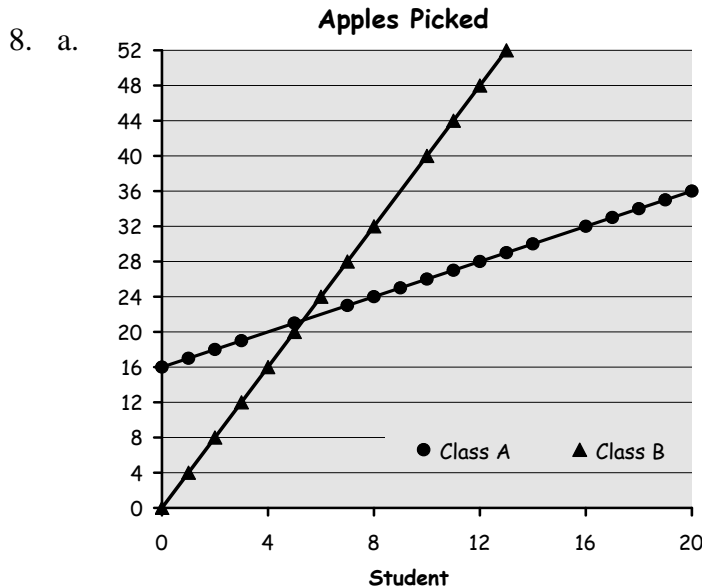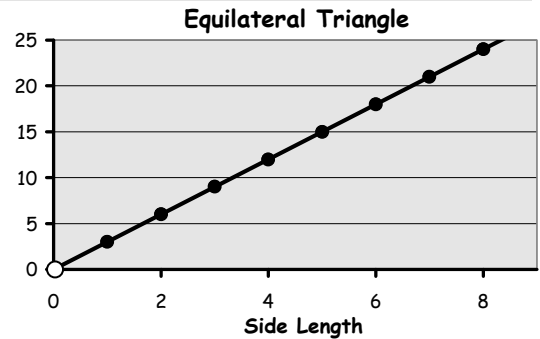
Let a and s represent the number of apples and student number respectively.

      Class A: $a = s + 16$
      Class B: $a = 4s$

b. Class A:
     Student 4 $\rightarrow$ $a = 4 + 16 = 20$ apples
     Student 6 $\rightarrow$ $a = 6 + 16 = 22$ apples
     Student 15 $\rightarrow$ $a = 15 + 16 = 31$ apples
     Class B:
   Student 9 $\rightarrow$ $a = 4(9) = 36$ apples

c. Student 17 $\rightarrow$ $a = 4(17) = 68$ apples   Student 19 $\rightarrow$ $a = 4(19) = 76$ apples
    Student 18 $\rightarrow$ $a = 4(18) = 72$ apples   Student 20 $\rightarrow$ $a = 4(20) = 80$ apples

d. The first 5 students from class A put their apples together to get a total of 80 apples.
    The first 5 students from class B pit their apples together to get a total of 40 apples.
    Therefore, the first 5 students from class A have picked enough apples.

e. The 20th student in class A picked 36 apples.
    The 20th student in class B picked 80 apples.
    Therefore, the 20th student in class A must pick another 44 apples.

f. Student 21 $\rightarrow$ $a = 21 + 16 = 37$ apples
    Student 22 $\rightarrow$ $a = 22 + 16 = 38$ apples
    Student 23 $\rightarrow$ $a = 23 + 16 = 39$ apples

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9. a. Nhean's speed is 250 m/min, so we know the slope of the line representing his speed is 250, and we get the equation this line to be $y = 250x$.

Alexis' speed is 290 m/min, so the slope for her line is 290. We also know that she starts two minute after Nhean. Thus, the equation for Alexis' line is $y = 290x - 2$.
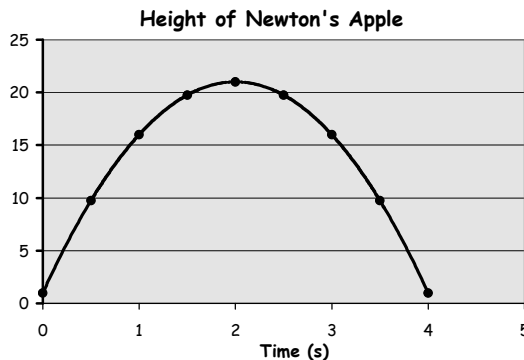

Bike Rac
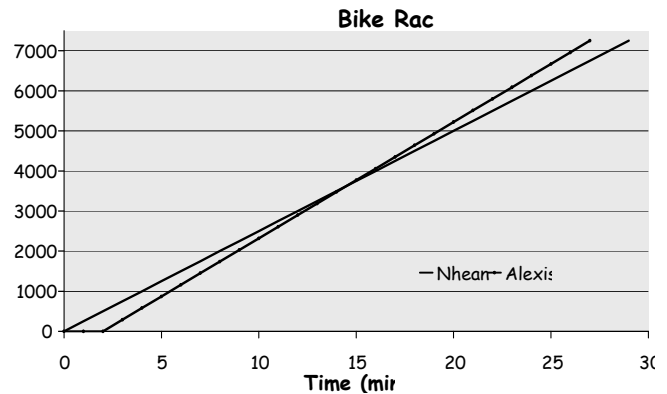
b. Alexis won the race by two minutes.

10. a.

Dawn's Day
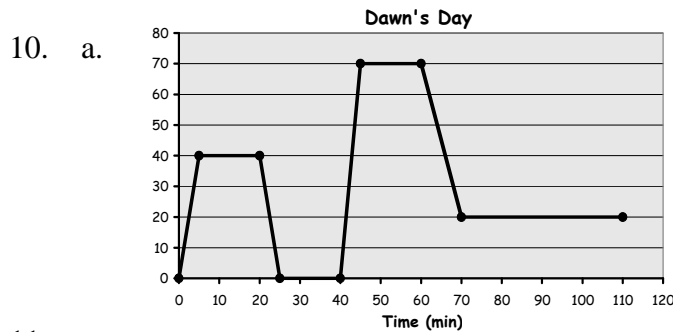
b. The whole trip took 110 minutes, which equals 1 hour and 50 minutes. Therefore, Dawn got home at 9:50 a.m..

11. a.

Height of Newton's Apple

b. The apple is thrown up in the air, and thanks to gravity it falls back down towards earth if nothing stops it. Therefore, the apple will reach a maximum height. The maximum height is 21 m, and it occurs when the apple is 2 seconds in the air.