Quick Review

Factor completely over the real numbers

1. $x^2 + 3x - 4$

$(x-1)(x+4)$

3. $3x^3 - 15x^2 + 18x$

$3x(x^2-5x+6)$
$3x(x-2)(x-3)$

2. $x^2 - 16$

$(x-4)(x+4)$

4. $2x^2 - 11x + 5$

$(2x-1)(x-5)$

Chapter 1

Functions and Graphs

1.1 Modeling and Equation Solving

1.2 Functions and Their Properties

1.3 Twelve Basic Functions

1.4 Building Functions from Functions

1.5 Parametric Relations and Inverses

1.6 Graphical Transformations

1.7 Modeling with Functions

Section 1-1: Day 1

Modeling & Equation Solving

Students will be able to:

- Use numerical, algebraic and graphical models to solve problems and will be able to translate from one model to another
- Use the Zero Factor Property

Tracking the Minimum Wage

The number in the table below shows the growth of the minimum hourly wage from 1955 to 2010. It also shows the MHW adjusted to the purchasing power of 1996 dollars.

a. In what five year period did the actual MHW increase the most?

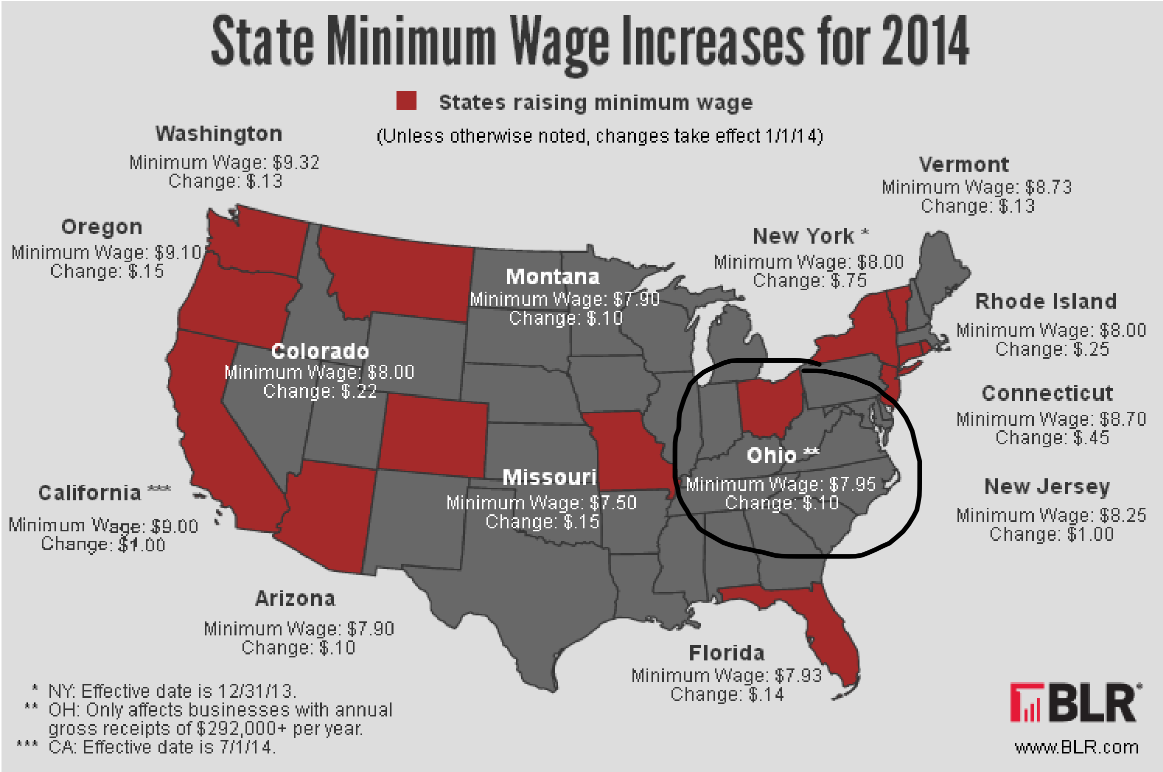
2005-2010

b. In what year did a worker earning the MHW enjoy the greatest purchasing power?

1970

c. A worker on minimum wage in 1980 was earning nearly twice as much as a worker on minimum wage in 1970, and yet there was great pressure to raise the minimum wage again...Why? Purchasing power was less

Year	MHW	Purchasing Power in 1996 Dollars
1955	.75	4.39
1960	1.00	5.30
1965	1.25	6.23
1970	1.60	6.47
1975	2.10	6.12
1980	3.10	5.90
1985	3.35	4.88
1990	3.80	4.56
1995	4.25	4.38
2000	5.15	4.69
2005	5.15	4.14
2010	7.25	5.22



Labor Force Participation Rate

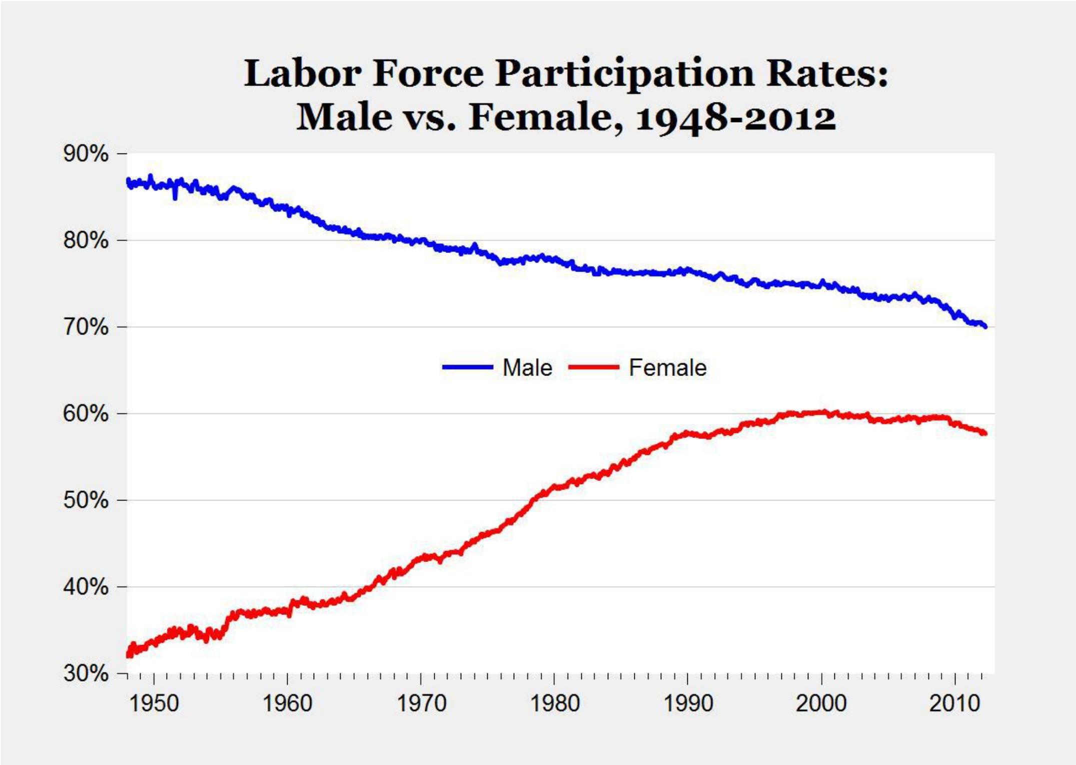
Year	Female	Male
1960	37.7	83.4
1965	39.3	80.5
1970	43.3	79.6
1975	46.3	77.2
1980	51.5	77
1985	54.5	76.1
1990	57.5	76.3
1995	58.9	74.6
2000	59.9	74.7
2005	59.3	73.2
2010	58.6	70.7

11. a) According to the numerical model, what has been the trend in females joining the work force since 1960?

increasing

b) In what 5-year interval did the percentage of women who were employed change the most?

1975-1980

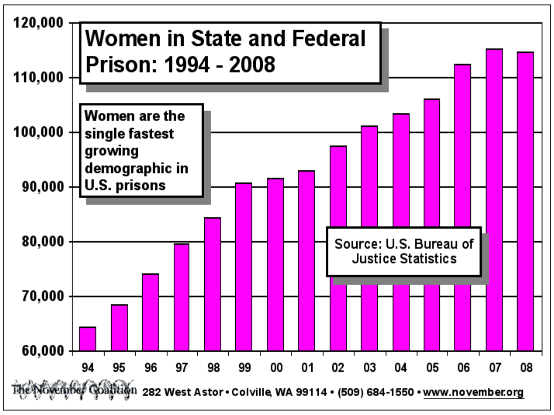


Analyzing Prison Populations

The table below shows the growth in the number of prisoners incarcerated in state and federal prisons at year's end for selected years between 1980 and 2010.

Is the population of female prisoners increasing over the years? YES

Year	Total	Male	Female
1980	329	316	13
1985	502	479	23
1990	774	730	44
1995	1125	1057	68
2000	1391	1298	93
2005	1528	1420	108
2010	1612	1499	113



#19

19. Enter the data from the "Total" column into list L_1. Enter the data from the "Female" column into L_2. Check a few computations to see that the procedures in (a) and (b) cause the calculator to divide each element of L_2 by the corresponding entry in L_1, multiply it by 100, and store the resulting list of percentages in L_3.

$$\left(\frac{L_2}{L_1}\right) \times 100$$

Algebraic Models

- uses formulas to relate variable quantities associated with the phenomena being studied
- can be used to generate numerical values of unknown quantities

$$E = mc^2$$

Comparing Pizzas

A pizzeria sells a rectangular 18" by 24" pizza for the same price as its large round pizza (24" diameter). If both pizzas are the same thickness, which option gives the most pizza for the money?

$A_{\square} = lw$

$= (18)(24)$

$= 432 \text{ in}^2$

$A_{\circ} = \pi r^2$

$= \pi (12)^2$

$= 452. \text{ in}^2$

#21

21. A garden shop sells 12" by 12" square stepping stones for the same price as 13" diameter round stones. If all the stepping stones are the same thickness, which option gives you the most rock for your money?

Exploration 1: Designing an Algebraic Model

A department store is having a sale in which everything is discounted 25% off the marked price. The discount is taken at the sales counter, and then a state sales tax of 6.5% and a local sales tax of 0.5% are added on.

1. The discounted price d is related to the marked price m by the formula d = km where k is a certain constant. What is k?

$d = km$

$k = \frac{d}{m} = \frac{100-25}{100} = \frac{75}{100} = .75$

$d = km$

$m = d/k$

2. The actual sale price s is related to the discount price d by the formula $\boxed{s = d + td,}$ where t is a constant related to the total sales tax. What is t ?

$t = 6.5 + .5 = 7$ or $.07$

3. Using the answers from 1 and 2 you can find a constant p that relates s directly to m by the formula s = pm. What is p ?

$S = pm \quad p = \frac{s}{m}$

$p = \frac{d + td}{\frac{d}{k}} = .8025$

4. If you only have $30, can you afford to buy a shirt marked $36.99?

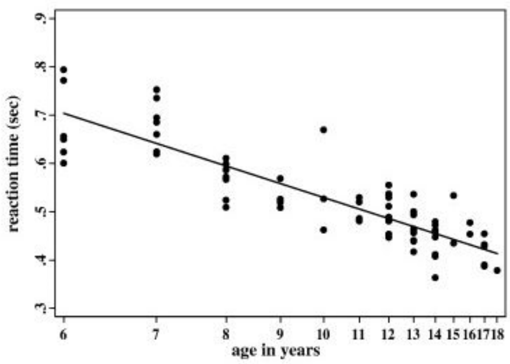
$36.99 \times .8025 = \$29.68$

5. If you have a credit card but are determined to spend no more than $100, what is the maximum total value of your marked purchases before you present them at the sales counter?

$\frac{100}{.8025} = \$124.$

Graphical Models

- visual representation of a numerical model or an algebraic model
- can be used to give insights into the relationships between variable quantities.



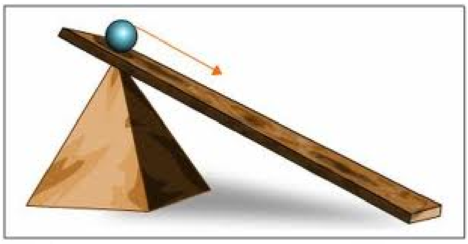
Visualizing Galileo's Gravity Experiments

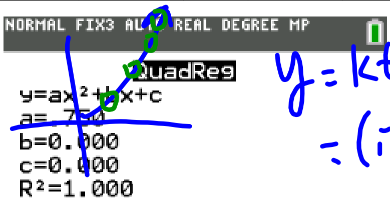
Galileo Galilei (1564 - 1642) spent a great deal of time rolling balls down inclined planes, carefully recording the distance they traveled as a function of elapsed time.

What graphical model fits the data below? parabola - vertex @ origin

Can you find an algebraic model that fits?

Elapsed time (seconds)	0	1	2	3	4	5	6	7	8
Distance travled (inches)	0	0.75	3	6.75	12	18.75	27	36.75	48





$y = kt^2$

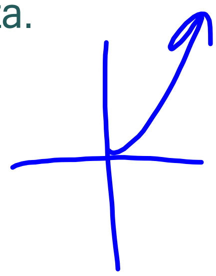
$= (.75)t^2$

#23

23. A physics student obtains the following data involving a ball rolling down an inclined plane, where t is the elapsed time in seconds and y is the distance traveled in inches.

t	0	1	2	3	4	5
y	0	1.2	4.8	10.8	19.2	30

Find an algebraic model that fits the data.



$y = 1.2t^2$

$= kt^2$

Fitting a Curve to Data

In example 2 we showed that the percentage of females in the US prison population has been steadily growing over the years. Model this growth graphically and use the graphical model to suggest an algebraic model.

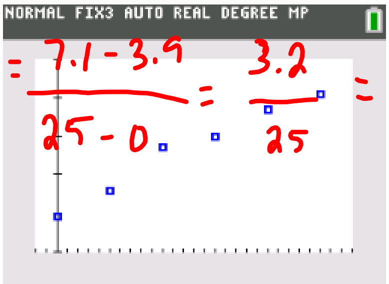
Percentage (*F*) of Females in the Prison Population *t* years after 1980

L_1 x	*t*	0	5	10	15	20	25
L_2 y	*F*	3.9	4.6	5.7	6.0	6.7	7.1

b

$y = mx + b$

$y = mx + 3.9$



$m = \frac{7.1 - 3.9}{25 - 0} = \frac{3.2}{25} = .128$

$\boxed{y = .128x + 3.9}$

#13 & #15

13. Model the data graphically with two scatter plots on the same graph, one showing the percentage of women employed as a function of time and the other showing the same for men. Measure time in years since 1960.

Year	Female	Male
1960	37.7	83.4
1965	39.3	80.5
1970	43.3	79.6
1975	46.3	77.2
1980	51.5	77
1985	54.5	76.1
1990	57.5	76.3
1995	58.9	74.6
2000	59.9	74.7
2005	59.3	73.2
2010	58.6	70.7

15. Model the data algebraically with linear equations of the form y = mx + b. Write an equation for the women's data using the 1960 and 2010 ordered pairs to compute the slope.

Year (x)	Female (y)	Male
0 1960	37.7	83.4
1965	39.3	80.5
1970	43.3	79.6
1975	46.3	77.2
1980	51.5	77
1985	54.5	76.1
1990	57.5	76.3
1995	58.9	74.6
2000	59.9	74.7
2005	59.3	73.2
50 2010	58.6	70.7

$$m = \frac{58.6 - 37.7}{2010 - 1960} =$$

$$\boxed{y = .418x + 37.7}$$

Pg. 74 Homework: # 3 - 30

Multiples of Three