Statistics and Functions
1st Semester Exam Review 2016-2017

Name _____
Date _____ Hour _____

If you are taking the exam this review is due the day of the exam for credit!!

About the exam:

- The exam covers
  - Chapter 1 (not including section 1-8)
  - Chapter 2 (not including section 2-9)
  - Chapter 3 – all
  - Chapter 9 (not including section 9-10)
- Other things to study/review
  - Old quizzes
  - Notes
- The exam is 76 multiple choice questions.

- You may create your own "cheat/hint sheet" to use on the exam. It can be a full sheet of paper. Front and Back. Hand written. This will be turned in with your exam. No formulas are provided on the exam. Any formulas/equations you look up or need for this review should go on your formula sheet.

- You will need to know how to do the following things on a graphing calculator:
  - Enter data into a list
  - Run a 1-variable statistic – know what (Sx and $\bar{x}$ represent)
  - Run a linear, exponential, quadratic, and/or cubic regression
  - Change a window
  - Enter equations into a y= and graph it
  - Find a correlation coefficient (catalog – DiagnosticOn)
  - Find a zero, maximum, or minimum

Chapter 1

1. Section 1-1 – Be able to read, interpret, and answer questions when given tables and graphs.
2. Section 1-1 – Be able to determine the measure in degrees of the central angle of a sector. See example 3. Page 9.

Class	Freshman	Sophomore	Junior	Senior
Students	452	425	403	387

Suppose a circle graph were used to display the data. What should be the measure in degrees of the central angle of the sector representing the freshman class?

3. Section 1-2/1-3 – be able to read, interpret, and answer questions using stem and leaf plots.

Refer to the stem and leaf plot at the right which gives the mean length in days of a hospital stay by state in 1993.

5 | 8 = 5.8 days

5	8 8 8 9 9
6	1 2 3 4 5 6 7 7 7 7 7 8 8 8
7	0 0 0 0 1 2 2 2 2 2 3 3 5 5 6 6 8
8	2 5 6
9	7
10	2 3 7
11	6
12	4
13	0 0 2
14	
15	
16	
17	
18	7

a) What is the mode for the data?
b) What is the median of the data?
c) (Section 1-4, pg. 33) Using the 1.5 x IQR criterion, determine if there are any outliers. If so, list them.

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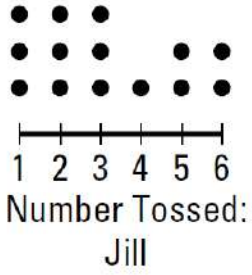
4. Section 1-2/1-3 – be able to read, interpret, and answer questions using dot plots.

Jill tossed a standard six-sided die several times. Each time she recorded the number tossed. Her results are shown in the dotplot at the right.



a) How many times was the dice rolled?
b) What is the mean?
c) What is the median?

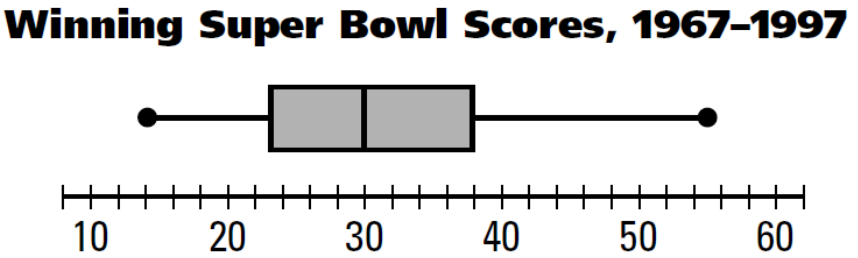
5. Section 1-3 – be able to evaluate sigma notation

Let $a_1 = -3, a_2 = 5, a_3 = 6, a_4 = 10, a_5 = 12$
Evaluate $\sum_{i=1}^{5} a_i^3 + 12$.

6. Section 1-3 – Be able to solve story problems involving means.
   a) Stuart Dent has scored 75, 85, 76, 92, and 87 on his first five tests. What score does Stu need on the next test in order to raise his mean score to 85?

   b) 30 students in Mrs. Royston's 4th hour Geometry class took a test. The mean score for these students was an 73. Two students missed the test because a field trip. When their scores were averaged in, the mean for the class fell to an 70. What was the sum of the two students' scores?

7. Section 1-4 – be able to read, interpret, and answer questions using box plots.



a) What is the range of scores?
b) What percent of scores were between 14 and 30?
c) What percent of scores were between 23 and 55?
d) What is the IQR of the scores?
e) What is the median of the scores?

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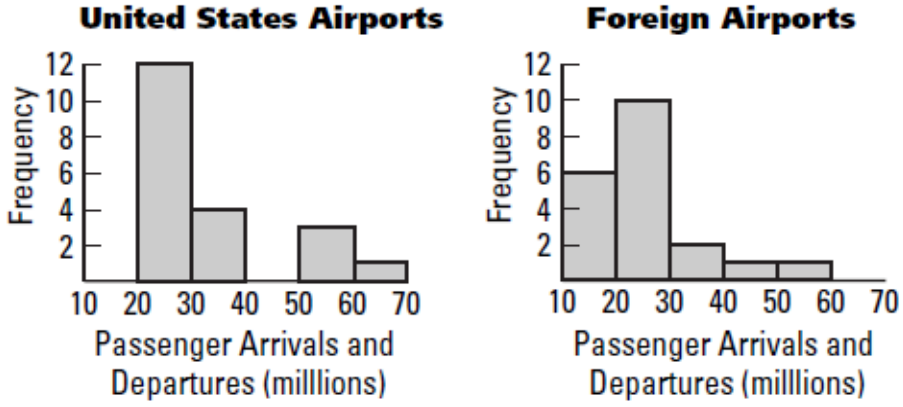
8. Section 1-5 – be able to read, interpret, and answer questions using box plots.

Use the histograms below, which show the distributions of passenger traffic during 1995 at the busiest United States and foreign airports. There are twenty airports in each group. Each interval includes the left endpoint, but not the right.



Source: *The World Almanac and Book of Facts 1997.*

a) What interval does the median lie in for Foreign Airports?
b) What interval does the 3rd quartile lie in for United States Airports?
c) Approximately what percent of the US airports have 50 million or more passenger arrivals and departures?

9. Section 1-6 – know the similarities and differences among the different types of graphical displays.

Match each characteristic with one of more types of graphs.

Choices

A	Box Plots
B	Stem and Leaf Plots
C	Scatterplots
D	Line Graphs
E	Histograms
F	Dotplots
G	Bar Graphs
H	Circle Graphs

1) Shows individual data points
2) May be used for one-variable data sets
3) Displays relation of parts to whole
4) Shows five-number summary
5) Displays distribution of data
6) May be used for two-variable data sets

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10. Section 1-7– know the relationship between variance and standard deviation. Know what standard deviation tells you about a set of data (the smaller the standard deviation the closer the data is to the mean – less spread out).

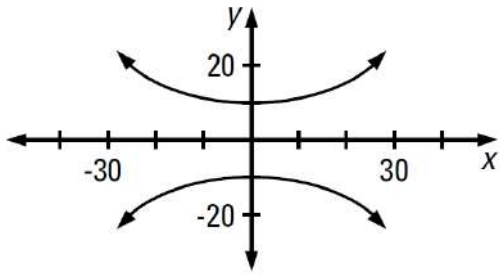
    You will not have to calculate variance or standard deviation by hand. You should know how to get them from the 1-variable statistics list.

    a) If the standard deviation of a set of numbers is x, what is the variance?
    b) If the variance of a set of numbers is w, what is the standard deviation?
    c) Also see section 1-7, page 60, #18

Chapter 2

11. Section 2-1 – Be able to determine the domain and range of a relation (via a graph, equations, or set of points) and tell if the relation is a function.

    a) Give the domain.



    b) Give the range.

    c) Is the relation a function?

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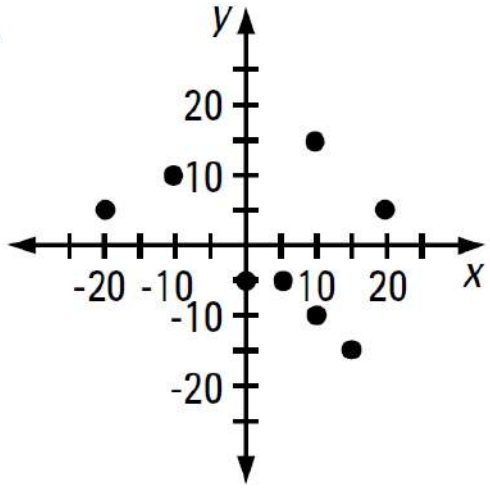
d) Give the domain.

e) Give the range.

f) Is the relation a function?



$$y = \frac{1}{(x+2)^2}$$

g) Give the domain.

h) Give the range.

i) Is the relation a function?

12. Section 2-1 – Be able evaluate functions described with Euler/function notation. (This also includes evaluating step functions – Section 2-7)

Let $g(x) = \lfloor 3.75 + 3x \rfloor$, $h(x) = x^2 - 4x$, and $k(x) = \lceil x - 1 \rceil$

Find

a) $g(-3)$

b) $h(-2)$

c) $h(5) \cdot g(1)$

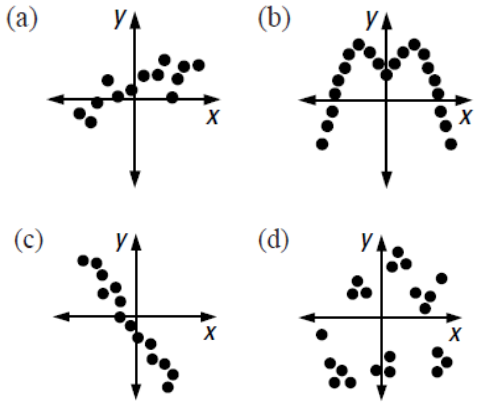
d) $\frac{k(2)}{g(-4)}$

13. Sections 2-2 and 2-3 – Know how to find and use lines of best fit as well as correlation coefficients.

For a set of data, the line of best fit is given by $y = -2.32 - 5.26x$ and $r^2 = 0.94$.

a) What is the correlation coefficient?

b) Which scatterplot could represent the data?



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14. Sections 2-2 and 2-3 – Know how to find and use lines of best fit as well as correlation coefficients.

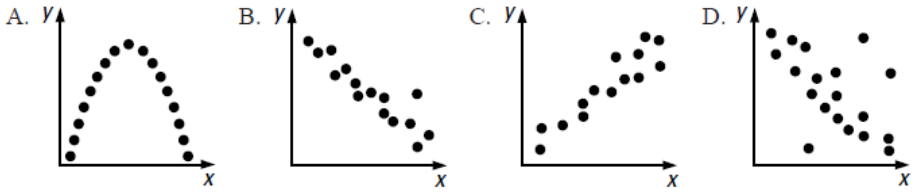
Refer to the table below, which gives the amount of money Americans spent on hardbound books in selected years from 1982 to 1994.

Year	1982	1985	1990	1992	1994
Amount (millions of dollars)	6,190	7,969	11,789	13,046	14,465

a) Use a statistics utility to find an equation for the line of best fit for these data. Let the independent variable be the number of years after 1900. Round to the nearest thousandths.
b) What is the correlation coefficient for these data?
c) Use the line of best fit to predict the amount of dollars Americans would have spent in 1987.
d) Using the line of best fit, what is the residual (error) for the year 1990 between the observed and the predicted values?

15. Sections 2-2 and 2-3 – Know about correlation coefficients.

For each scatterplot below make up your own correlation coefficient value and describe the strength of the linear relation.



16. Sections 2-2 and 2-3 – Know about correlation coefficients.

When does a scatterplot have a correlation coefficient of positive or negative 1?

17. Sections 2-4 and 2-5 – Know about exponential models, their graphs, and how to find a model.

How are the graphs of $f(x) = 2^x$ and $g(x) = \left(\frac{1}{2}\right)^x$ related? See section 2-4. Page 107. Example 2.

18. Sections 2-4 and 2-5 – Know about exponential models, their graphs, and how to find a model.

In a study of the change in an insect population, there were about 170 insects four weeks after the study began, and about 320 after two more weeks. Assume an exponential model of growth.

a) Find an equation relating the population to the time in weeks.
b) Estimate the initial number of insects.
c) Predict the number of insects 5 weeks after the study began.

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19. Sections 2-4 and 2-5 – Know about exponential models, their graphs, and how to find a model.

    In 1995, the population of the China was about 1,198,000,000 with an average annual growth rate of about 1.01%. Suppose the growth rate remains unchanged. What is an estimate of China's population in the year 2005?

20. Section 2-6 – Quadratic Models including Newton's equation $h(t) = \frac{-1}{2}gt^2 + v_o t + h_o$

    An object is launched straight up from ground level so that its height *h* meters above the ground as a function of times *t* seconds after launch is given by the equation $-4.9t^2 + 88.2t$.
    a) What is the maximum height the object will reach?
    b) About how long after launch will the object hit the ground?

Window if you want to do it that way … -5, 20, 1, -100, 500, 50, 1

21. Section 2-6 – Quadratic Models including Newton's equation $h(t) = \frac{-1}{2}gt^2 + v_o t + h_o$

    A weather balloon is at an altitude of 10,000 meters when it accidentally bursts. The instruments inside fall to Earth.
    a) Acceleration due to gravity is 9.8 m/s2. Find an equation that gives the height *h* meters above Earth of the falling instruments as a function of time *t* seconds after the balloon bursts.
    b) How long after the balloon bursts will the instruments hit Earth?

Window if you want to do it that way … -5, 60, 1, -1000, 11000, 250, 1

22. Section 2-7. Step functions. Know how to evaluate and identify a correct equation using them. You will not have to graph them.

    a) Section 2-7. Page 132. #15
    b) Chapter Review. Page 156. #50

23. Section 2-8. Choosing a good model based on the graphs of the residuals.

    a) Chapter review. Page 157. #72.

Chapter 3

24. Section 3-1. Know the graphs, names, and equations for the parent functions. You should also be able to give the domain and range of them.

    The parent functions you need to know are
    1) linear 2) parabola/quadratic 3) cubic 4) hyperbola
    5) inverse square curve 6) square root 7) absolute value
    See section 3-1. Page 162 and/or the chapter 3 parent function handout used in class

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25. Section 3-1. Know the graphs, names, and equations for the parent functions. You should also be able to give the domain and range of them.

Consider the $y = \frac{1}{4}x^2 - 6$

a) What is the equation for the parent function?
b) What is the name of the parent function?
c) Does it open up or down?
d) Where's the vertex?
e) Compared to the parent function has this graph undergone a horizontal shrink or stretch?

26. Section 3-2. Describe the effects of translations on functions and their graphs.

a) Give an image equation of $y = \sqrt{x}$ under the translation $T:(x,y) \rightarrow (x-2, y+4)$.

b) Give the translation rule which has the effect of moving each point 16 units up and 7 units to the left.

c) Describe the translation of $y + 8 = \frac{1}{x-4}$.

d) The graph of a function *f* has asymptotes with equations x= -6 and y= 3 . Find equations for the asymptotes of the image of *f* under the transformation $T(x,y) = (x+6, y+3)$.

27. Section 3-3. Describe the effects of translations on measures of center or spread.

A set of data has the following statistical measures.

Mean: 45	Variance: 25
Minimum: 18	Maximum: 62

Suppose the data is translated by adding 5 from each data value. Find each statistical measure for the adjusted set of data.

a) Mean
b) Range
c) Variance
d) Standard Deviation

28. Section 3-4. Symmetries of graphs. Odd and even functions.

Tell whether or not the graphs are odd, even, symmetric to the x-axis, or none of the above. If you want to you can graph these on a standard window.

a) $y = \frac{1}{x^2}$

b) $y = \frac{1}{x^2} + x$

c) $y = \frac{1}{x}$

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d) $y = x^3 + x$

29. Section 3-5. Describe the effects of scale changes on functions and their graphs.

a) The x-intercepts of a graph are 3, 0, -2 and 5. What are the x-intercepts of the image of f under the transformation $S(x,y) = (-4x, 2y)$?
b) Give the scale change rule which has the effect of shrinking a graph vertically by a magnitude of $\frac{1}{3}$ and stretching it horizontally by a magnitude of 6?
c) Give the parent function and the scale change rule for the equation $2y = \sqrt{\frac{x}{4}}$.

30. Section 3-6. Describe the effects of scale changes on measures of center and spread.

A set of data has the following statistical measures.

Mean: 45	Variance: 25
Minimum: 18	Maximum: 62
Median: 32	

Suppose the data is scaled by multiplying each data value by 2. Find each statistical measure for the adjusted set of data.

a) Mean
b) Median
c) Range
d) Variance
e) Standard Deviation

31. Section 3-7. Know how to evaluate, derive, and give the domain of composite functions.

Let $f(x) = \sqrt{x+5}$
$g(x) = x^3$
$h(x) = \frac{1}{x-5}$
$k(x) = x + 7$

a) Find $f(g(4))$
b) Find $k \circ f(20)$
c) Find $f(g(x))$
d) Find $h \circ k$
e) Give the domain of $h \circ k$

32. Section 3-8. Know properties and characteristics of inverse functions.

If f and g are inverse functions then
a) What's true about their domain and ranges?
b) How are their graphs related?
c) What does $f \circ g$ and $g \circ f$ equal?

33. Section 3-8. Know how to tell if a graph's inverse is a function. The horizontal line test.

a) Chapter Review. Page 229. #'s 73, 74, and 75

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h) What is a_4?
i) What is a_{n-1}?
j) What is a_1?

34. Section 3-8. Be able to provide the inverse.
    Give the inverse of:
    a) (2,3), (4,5), (-7, 10), (1, 2)
    b) $h(x) = \frac{1}{x+6} + 1$
    c) $g(x) = x - 5$

35. Section 3-9. Be able to calculate a z-score and use them to solve problems.

    a) Section 3-9 bookwork. Page 218-219. #'s 12 and 16.

Chapter 9

36. Section 9-1. Polynomial Models.

    a) A box has a length of (40-2x) a width of (60-2x) and a height of x. Express the volume of the box as a polynomial function in terms of x

    Consider the polynomial $f(x) = 6x^5 - 3x^3 + x^2 - 8x + 2$
    b) What is the degree of f(x)?
    c) What is the constant?
    d) What is the leading coefficient?
    e) What is n?
    f) What is a_5?
    g) What is a_n?

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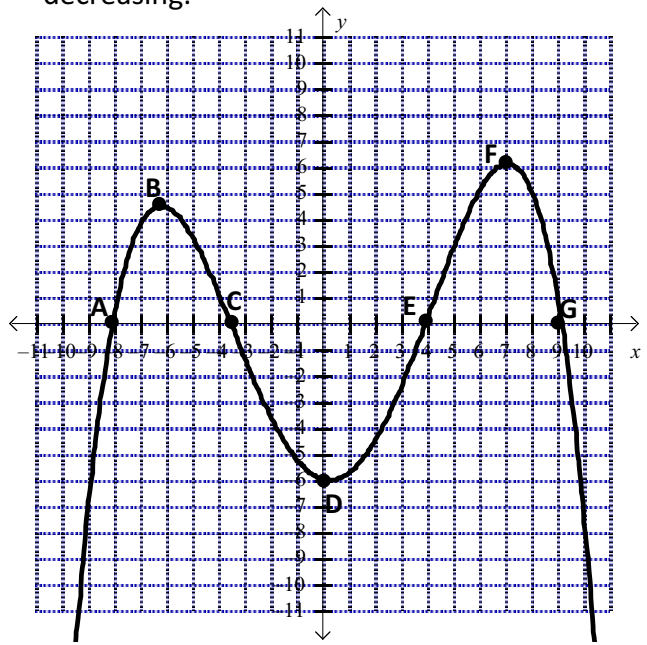
37. Section 9-2. Relative Extrema, positive, negative, increasing, decreasing.



a) What is the maximum value(s)?

b) What is the minimum value(s)?

c) What is the relative maximum value(s)?

d) What is the relative minimum value(s)?

e) Give the interval where the graph is positive.

f) Give the interval where the graph is negative.

g) Give the interval where the graph is increasing.

h) Give the interval where the graph is decreasing.

38. Section 9-1. Be able to determine the degree of a polynomial.

a) What is the degree of $h(x) = 3x^6y^3 + 10x^6y^5 - z^{10}$

b) What is the degree of $g(x) = (3x + 1)^6(x - 2)^3(2x - 1)$?

39. Section 9-3. Determine the degree and model for a polynomial based on a table of values.

Given that $y = f(x)$, where f is a polynomial function, determine degree of f from the following table.

x	0	1	2	3	4	5	6	7
y	5	10	19	26	25	10	-25	-86

a) What is the degree of the polynomial?

b) Find an equation for the polynomial.

40. Section 9-4. Long division and the remainder theorem.

a) Use the remainder theorem to find the remainder when $7x^5 - x^3 + 1$ is divided by x-2.

b) Use long division to find the remainder and the quotient

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41. Section 9-5/9-6/9-7. Finding factors and zeros of polynomials and using factors and zeros to determine the polynomial. This includes complex zeros.

    a) If q is a polynomial function and $q(3-i)=0$, provide the factors of the polynomial. Also determine the polynomial.
    b) Factor x^2+7
    c) Solve $x^2-2x+26$
    d) Find the polynomial p(x) with real coefficients, leading coefficient 1, and of the lowest degree possible that has the zeros 3, $2+4i$, and $5i$.

42. Section 9-6. Complex numbers.

    Let $m=5+2i$ and $n=4-i$

    Find in $a+bi$ form

    a) m-n
    b) n-3m
    c) mn
    d) n^2
    e) $\frac{m}{n}$

43. Section 9-8. Sum and differences of cubes theorem. MAKE SURE YOU HAVE THE FORMULAS. Page 604

    $x^3+y^3=(x+y)(x^2-xy+y^2)$
    $x^3-y^3=(x-y)(x^2+xy+y^2)$

    Factor

    a) $125n^3-27m^3$
    b) $343x^6y^9+z^3$

44. Section 9-9. Advanced factoring techniques.

    Factor

    a) $2x^3+12x^2-5x-30$
    b) $6x^2-13x+5$
    c) $y^2-xy+5x-5y$

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Answers

1) No problem
2) 97.6°
3) a) 6.7 b) 7.15 c) Q_1=6.7, Q_3=8.2, IQR=1.5, lower bound=4.45, upper bound=10.45 so the outliers are 10.7, 11.6, 12.4, 13.0, 13.0, 13.2, 18.7
4) a) 14 b) ≈ 3.14 c) 3
5) 3054 (cube 1st then add 12 at the end)
6) a) 95 b) 50
7) a) 41 b) 50% c) 75% d) 15 e) 30
8) a) $20 \le x < 30$ b) $30 \le x < 40$ c) 4/20=20%
9) 1) B,C,D,F 2) A, B, E, F, G 3) H 4) A
   5) A, B, F 6) C, D, and sometimes G
10) a) x^2 b) $\sqrt{w}$ c) answer: choice a
11) a) all real numbers b) $y \le -10 \text{ or } y \ge 10$ c) no
    d) $\{-20, -10, 0, 5, 10, 15, 20\}$
    e) $\{-15, -10, -5, 5, 10, 15\}$
    f) No g) all reals except x=-2
    h) all reals except y>o i) yes
12) a) -6 b) 12 c) 30 d) -1/9
13) a) -.9695 b) c
14) a) $y = 699.895x - 51318.911$
    b) .999
    c) 9571.954 million
    d) 117.361 million
15) Answer may vary for r's
    A) r=0, no linear correlation
    B) r=.98, strong negative correlation
    C) r=.94, strong positive correlation
    D) r=.7, weak negative correlation
16) When all the points lie on the regression line.
    Positive=positive slope, negative=negative slope
17) Reflections over the y-axis, their y-intercepts are both (0,1), domains are all real numbers, and range is y>0
18) a) $y = 48(1.372)^x$
    b) 48
    c) 233
19) b=1.0101 a=1198000000
    $y = 1198000000(1.0101)^{10} = 1{,}324{,}648{,}125$
20) a) 396.9 meters (max occurs at 9 seconds) b) 18 sec
21) a) $y = -4.9t^2 + 10000$ b) t ≈ 45.2 sec
22) a) answer: choice b
    b) answer: choice b
23) The linear model is a bad model because the residuals are first negative, then positive, and then negative again (parabola shaped). This indicates that there is probably a better model. The quadratic model is a better model because the residuals are closer to the x-axis (closer to zero) and the residuals are in no pattern like the linear model was.
24) No problem
25) a) $y = x^2$ b) parabola c) up d) -6
    e) horizontal stretch (it's flatter than the parent function)
26) a) $y = \sqrt{(x+2)} + 4$
    b) $T(x,y) = (x-7, y+16)$
    c) right 4 and down 8

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d) $x = 0 \; and \; y = 6$

27) a) 50 b) 44 c) 25 d) 5

28) a) even b) none/neither c) odd d) odd

29) a) -12, 0, 8, -20

b) $S(x,y) = (6x, \frac{y}{3})$

c) $y = \sqrt{x}; \; S(x,y) = \left(4x, \frac{y}{2}\right)$

30) a) 90 b)64 c)88 d)100 e)10

31) a)$\sqrt{69}$ b) 12 c)$\sqrt{x^3 + 5}$ d) $\frac{1}{x+2}$ e) all reals except x=-2

32) a) they switch b)reflections over y=x c) x

33) #73) no; fails HLT #74) no; fails HLT #75) yes; passes HLT

34) a) (3,2), (5,4), (10, -7), (2,1)

b) $y = \frac{1}{x-1} - 6$

c) $y = x + 5$

35) #12) $x \approx 136.25$ #16) 3.48

36) a) $V(x) = 2400x - 200x^2 + 4x^3$

b) 5 c) 2 d) 6 e) 5 f) 6 g) 6 h) 0 i) 0 j)-8

37) a) F b) None c) B, F d) D

e) $A < x < C, \; E < x < G$

f) $x < A, \; C < x < E, \; x > G$

g) $x < B, \; D < x < F$

h) $B < x < D, \; x > F$

38) a) 11 b) 10

39) a) the 3rd difference is the constant -6, so it's degree 3

b) $y = -x^3 + 5x^2 + x + 5$

40) a) $p(2) = 217$

b) quotient: $7x^4 + 14x^3 + 27x^2 + 54x + 108$

remainder: 217

41) a) zeros are $3 - i \; and \; 3 + 1$

factors are $\left(x - \left(3 - i\right)\right)\left(x - \left(3 + i\right)\right)$

$= \left(x - 3 + i\right)(x - 3 - i)$

b) $\left(x - i\sqrt{7}\right)(x + i\sqrt{7})$

c) quadratic formula $x = 1 \pm 5i$

d) zeros are 3, 2+4i, 2-4i, 5i, and -5i

factors are

$\left(x - 3\right)\left(x - \left(2 + 4i\right)\right)\left(x - \left(2 - 4i\right)\right)\left(x - 5i\right)\left(x + 5i\right)$

$\left(x - 3\right)\left(x - 2 - 4i\right)\left(x - 2 + 4i\right)\left(x - 5i\right)(x + 5i)$

$\left(x - 3\right)\left(x^2 - 4x + 20\right)(x^2 + 25)$

$x^5 - 7x^4 + 57x^3 - 235x^2 + 800x - 1500$

42) a) $1 + 3i$

b) $-11 - 7i$

c) $22 + 3i$

d) $15 - 8i$

e) $\frac{18}{17} + \frac{13}{17}i$

43) a) $\left(5n - 3m\right)(25n^2 + 15mn + 9m^2)$

b) $\left(7x^2y^3 + z\right)(49x^4y^6 - 7x^2y^3z + z^2)$

44) a) $\left(2x^2 - 5\right)(x + 6)$

b) $\left(2x - 1\right)(3x - 5)$

c) $\left(y - 5\right)(y - x)$