Honors Finite Math – Precalculus Review – Homework Packet Name: _____

Day 1 – Function Properties

In Problems 1–8 find the following values for each function:
(a) f(0) (b) f(1) (c) f(−1) (d) f(2)

5. $f(x) = |x| + 4$

In Problems 9–12 copy the table and fill in the missing values of the given equations. Use these points to graph each function.

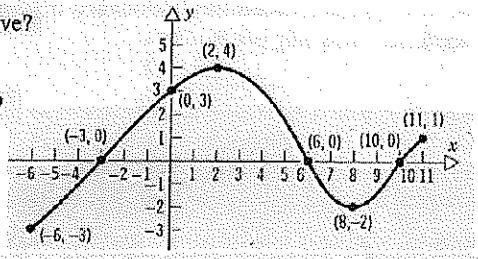
9. $y = x - 3$

x	0		2	−2	4	−4
y		0				

In Problems 13–24 use the given graph of the function f.

15. Is $f(11)$ positive or negative?

19. What is the domain of f?



In Problems 25–42 graph each function. Find any intercepts.

30. $y = -x^2 + 3$

35. $y = x^2 - 1$

39. $y = \dfrac{1}{x + 3}$

45. $f(x) = \dfrac{2x^2}{x^4 + 1}$

(a) Is the point $(-1, 1)$ on the graph of f?
(c) If $f(x) = 1$, what is x?
(b) If $x = 2$, what is $f(x)$?
(d) What is the domain of f?

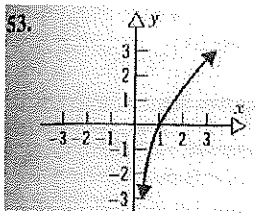
46. $f(x) = \dfrac{2x}{x - 2}$

(a) Is the point $(\frac{1}{2}, -\frac{2}{3})$ on the graph of f?
(c) If $f(x) = 1$, what is x?
(b) If $x = 4$, what is $f(x)$?
(d) What is the domain of f?

Day 2 – Function Properties

In Problems 47–60 determine whether the graph is that of a function by using the vertical line test. If it is a function, use the graph to find: (a) its domain and range; (b) the intercepts, if any.

53.



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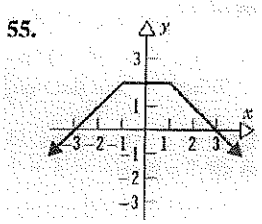

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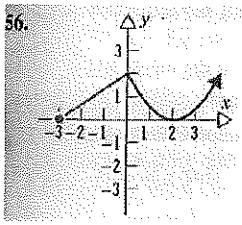

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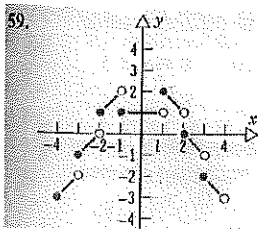


In Problems 61–74 find the domain of each function.

65. $g(x) = \dfrac{x}{x^2 - 1}$

69. $h(x) = \sqrt{3x - 12}$

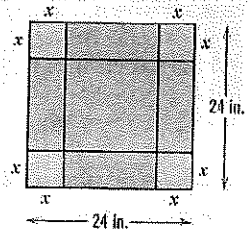
75. If $f(x) = 2x^3 + Ax^2 + 4x - 5$ and $f(2) = 3$, what is the value of A?

79. If $f(x) = (2x - A)/(x - 3)$ and $f(4) = 0$,
what is the value of A?
Where is f not defined?

85. $P_1 = (2.3, 0.3)$; $P_2 = (2.3, 1.1)$
What is the distance between points given?

89. Area The perimeter of a rectangle is 120 ft. Express the area as a function of the width alone, and state the domain of this function.

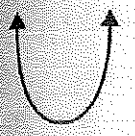
99. Making Boxes An open box with a square base is to be made from a square piece of cardboard 24 inches on a side by cutting out a square from each corner and turning up the sides (see the figure). Express the volume V of the box as a function of the length x of the side of the square cut from each corner.

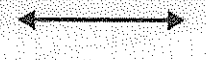


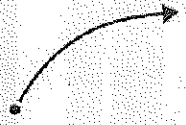
Day 3 – Function Families

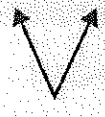
In Problems 1–8 match each graph to the function whose graph most resembles the one given.

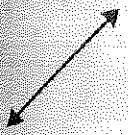
(a) Constant function *(b) Linear function* *(c) Square function*
(d) Cube function *(e) Square root function* *(f) Reciprocal function*
(g) Absolute value function *(h) Greatest integer function*

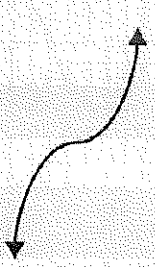
1. 

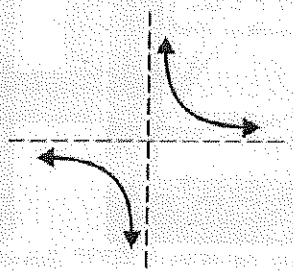
2. 

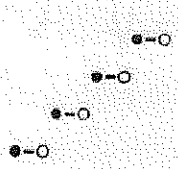
3. 

4. 

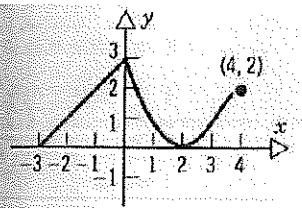
5. 

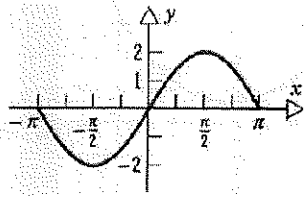
6. 

7. 

8. 

In Problems 9–20 the graph of a function is given. Use the graph to find (a) its domain and range; (b) the intervals on which it is increasing, decreasing, or constant; (c) the intercepts, if any.

9. 

13. 

In Problems 25–36 find the following for each function:
(a) $f(-x)$ (b) $-f(x)$ (c) $f(2x)$ (d) $f(x-3)$ (e) $f(1/x)$ (f) $1/f(x)$ (g) $f(x^2)$

25. $f(x) = 2x + 3$

29. $f(x) = x^3 - 3x$

Day 4 – Function Families, Difference Quotient

In Problems 37–46 find the difference quotient, for each function. Be sure to simplify.

$$\frac{f(x+h)-f(x)}{h} \qquad h \neq 0$$

37. $f(x) = 3$

41. $f(x) = 3x^2 - 2x$

45. $f(x) = \frac{1}{x}$

In Problems 47–70 (a) find the domain of each function; (b) locate any intercepts; (c) graph each function; (d) based on the graph, find the range.

49. $g(x) = x^2 - 4$

53. $f(x) = \sqrt{x-2}$

61. $f(x) = \begin{cases} 2x & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$

65. $f(x) = \begin{cases} |x| & \text{if } -2 \leq x < 0 \\ 1 & \text{if } x = 0 \\ x^3 & \text{if } x > 0 \end{cases}$

In Problems 71–82 determine whether the given quadratic function opens up or down. Find the vertex, the y-intercept, and the x-intercepts, if any. Graph each function.

77. $y = f(x) = -x^2 + 1$

81. $y = f(x) = 4 - x^2$

85. Discounts A book club offers the following deal to its members: If 6 books are bought at the full price of \$20.00 apiece, additional books can then be bought at \$12.00 apiece. There is a limit of 10 books per customer. Express the cost of the books as a function of the number bought and draw the graph.

Day 5 – Exponential Functions

In Problems 1–16 evaluate each expression.

1. $27^{2/3}$ **5.** $16^{-1/2}$ **9.** $(\frac{1}{9})^{1/2}$ **13.** $(9^{1/3})(3^{1/3})$

In Problems 17–24 use a calculator to compute each expression. Round your answer to three decimal places.

17. 2^x, for $x = -\frac{1}{4}$

21. 2^x, for $x = 0.1$

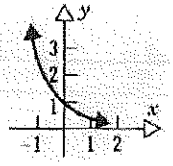
In Problems 33–42 graph each function.

33. $f(x) = 3^x$

In Problems 25–32 the graph of an exponential function is given. Match each graph to the correct function. State the reason(s) for your choice.

A. $y = 3^x$ *B.* $y = 3^{-x}$ *C.* $y = -3^x$ *D.* $y = -3^{-x}$
E. $y = 3^x - 1$ *F.* $y = 3^{x-1}$ *G.* $y = 3^{1-x}$ *H.* $y = 1 - 3^x$

25.



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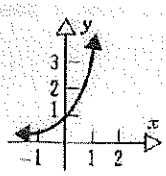

In Problems 45–52 solve each equation.

45. $8^x = 16$ **49.** $5^{-3x} = \frac{1}{25}$

57. Compound Interest Find the amount after 1 year if \$500 is invested at 6% compounded continuously for 1 year. What is the amount if the rate is $6\frac{1}{4}\%$ compounded quarterly? Which is better?

61. Reliability of a Product The proportion of batteries that still maintain a charge after x years of use is

$$f(x) = (\tfrac{3}{4})^x$$

(a) What proportion of the batteries still maintain a charge after 2 years?

(b) What proportion of the batteries will fail to hold a charge between the second and third year of use?

(c) What proportion of the batteries will fail to hold a charge within the first year of use?

65. Water Depletion Annual water consumption per person is estimated to be

$$W(y) = 1400(1 + e^{0.50(y-1950)})$$

where y is the year and W is measured in gallons.

(a) What was the total water consumption in 1950, to the nearest gallon?

(b) What will the total water consumption be in 2000?

Day 6 – Logarithmic Functions

In Problems 1–6 write each logarithm expression using exponential notation.

1. $\log_3 9 = 2$

5. $\log_a P = Q$

In Problems 7–10 write each exponential expression using logarithmic notation.

9. $a^{1/2} = 3$

In Problems 11–16 evaluate each expression.

13. $\log_{10} 10^{-3}$

In Problems 17–24 use $\log_{10} 2 = 0.3010$, $\log_{10} 3 = 0.4771$, and $\log_{10} 5 = 0.6990$ to compute each quantity.

17. $\log_{10} 12$

21. $\log_{10} 36$

In Problems 25–30 use the properties of logarithms to write each expression as a single logarithm.

25. $\ln 3 + \ln x$

29. $\ln(x + 1) + \ln(x + 2) + \ln(x + 3)$

In Problems 39–48 use the properties of logarithms to solve for x.

41. $\ln x + \ln 6 = \ln 7$

45. $4 = e^{0.08x}$

In Problems 49–52 graph each function.

49. $f(x) = \log_5 x$

53. If $3^x = e^{cx}$, find c.

57. Tripling Time How long will it take an amount P to triple if it is invested at 10% interest compounded continuously?

60. Population Growth The formula $A = Pe^{rt}$ can also be used as a mathematical model for population growth over short periods of time. Thus, if

P_0 = Population at time $t = 0$

r = Rate compounded continuously

t = Time in years

P = Population at time t

then

$$P = P_0 e^{rt}$$

How long will it take the earth's population to double if it continues to grow at the rate of 2% per year (compounded continuously)?

61. Population Growth Repeat Problem 60 assuming that the growth rate is 1% per year (compounded continuously).

65. Radioactive Decay A radioactive substance is decaying according to

$$y = 200e^{-0.15t}$$

where t is measured in weeks. What is the half-life, to the nearest hundredth of a week, if we start with 200 grams?

Precalculus Review Problems

In Problems 15–20 find the following for each function:
(a) $f(-x)$ *(b)* $-f(x)$ *(c)* $f(x+2)$ *(d)* $f(x-2)$

15. $f(x) = \dfrac{x}{x^2 - 4}$

In Problems 21–32 find the domain of each function.

21. $f(x) = \dfrac{x}{x^2 - 4}$

23. $f(x) = \sqrt{2 - x}$

29. $G(x) = \begin{cases} |x| & \text{if } -1 \le x \le 1 \\ 1/x & \text{if } x > 1 \end{cases}$

In Problems 33–42
(a) Find the domain of each function. *(b) Locate any intercepts.*
(c) Graph each function. *(d) Based on the graph, find the range.*

39. $f(x) = \sqrt{1 - x}$

41. $F(x) = \begin{cases} x^2 + 4 & \text{if } x < 0 \\ 4 - x^2 & \text{if } x \ge 0 \end{cases}$

In Problems 43–48 graph each quadratic function. Label the vertex, the y-intercepts, and the x-intercepts, if any.

45. $f(x) = x^2 + 2x - 8$

In Problems 49–54 use a calculator to approximate each natural logarithm to two decimal places.

49. ln 6.95

53. ln 12.5

In Problems 55–58 write each expression as a single logarithm.

57. $3 \ln x - 2 \ln y + 6 \ln z$

In Problems 59–68 solve for x. Express each answer rounded to two decimal places.

59. $3^x = 4$

61. $4^{x-1} = 7$

In Problems 69–78 solve each logarithmic equation.

69. $\log_{10}(3x + 1) = \log_{10}(2x + 3)$

71. $\log_2(x + 1) = 3$

73. $\log_4(3x + 2) - \log_4 x = \log_4 5$

In Problems 79–82 write each logarithmic equation in exponential form.

81. $\log_p 13 = 3$

83. Sketch the graph of $y = 4^x$ and $y = \log_4 x$.

91. Compound Interest How long will it take $10,000 to double if it can be invested at 12% interest compounded continuously?

Regression Models

1.

Income (in dollars)	Ulcer rate (per 100 population)
4,000	14.1
6,000	13.0
8,000	13.4
12,000	12.5
16,000	12.0
20,000	12.4
30,000	10.5
45,000	9.4
60,000	8.2

(a) Find and graph the least squares regression line.

(b) Use the linear model in part (a) to estimate the ulcer rate for an income of $25,000.

(c) According to the model, how likely is someone with an income of $80,000 to suffer from peptic ulcers?

2. The table below lists the average carbon dioxide level in the atmosphere, measured in parts per million at Mauna Loa Observatory from 1980 to 2002. Use the data to find a model for the carbon dioxide levels.

Year	CO_2 level (in ppm)	Year	CO_2 level (in ppm)
1980	338.7	1992	356.4
1982	341.1	1994	358.9
1984	344.4	1996	362.6
1986	347.2	1998	366.6
1988	351.5	2000	369.4
1990	354.2	2002	372.9

3. Biologists have observed that the chirping rate of crickets of a certain species appears to be related to temperature. The table shows the chirping rates for various temperatures.

Temperature (°F)	Chirping rate (chirps/min)	Temperature (°F)	Chirping rate (chirps/min)
50	20	75	140
55	46	80	173
60	79	85	198
65	91	90	211
70	113		

(a) Make a scatter plot of the data.
(b) Find and graph the regression line.

(c) Use the linear model in part (b) to estimate the chirping rate at 100 °F.

4. A ball is dropped from the upper observation deck of the CN Tower, 450 m above the ground, and its height above the ground is recorded at 1-second intervals in the following table.

Time (seconds)	Height (meters)	Time (seconds)	Height (meters)
0	450	5	332
1	445	6	279
2	431	7	216
3	408	8	143
4	375	9	61

(a) Find a model to fit the data.

(b) Use the model to estimate the height after 5 seconds (how close is this estimate to the actual data?)

(c) Use the model to predict the time at which the ball hits the ground.

5. Use the data in the table to model the population of the world in the 20th century by a cubic function. Then use your model to estimate the population in the year 1925 and 2011.

Year	Population (in millions)	Year	Population (in millions)
1900	1650	1960	3040
1910	1750	1970	3710
1920	1860	1980	4450
1930	2070	1990	5280
1940	2300	2000	6080
1950	2500		

6. Use the data in the table from problem 5 to model the population by an exponential function. Then use this model to estimate the population in the year 1925 and 2011.

7. The table shows the mean (average) distances d of the planets from the sun (taking the unit of measurement to be the distance from the earth to the sun) and their periods T (time of revolution in years).

Planet	d	T	Planet	d	T
Mercury	0.387	0.241	Jupiter	5.203	11.861
Venus	0.723	0.615	Saturn	9.541	29.457
Earth	1.000	1.000	Uranus	19.190	84.008
Mars	1.523	1.881	Neptune	30.086	164.784

(a) Fit a power model to the data.

(b) Kepler's Third Law of Planetary Motion states that 'The square of the period of revolution of a planet is proportional to the cube of its mean distance from the sun." Does your model corroborate Kepler's Third Law?