LIFEPAC®

MATH

TEACHER'S GUIDE

▸ **11th Grade**

Alpha Omega
PUBLICATIONS

MATH 1100
Teacher's Guide

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INSTRUCTIONS FOR MATH

The LIFEPAC curriculum from grades two through twelve is structured so that the daily instructional material is written directly into the LIFEPACs. The student is encouraged to read and follow this instructional material in order to develop independent study habits. The teacher should introduce the LIFEPAC to the student, set a required completion schedule, complete teacher checks, be available for questions regarding both content and procedures, administer and grade tests, and develop additional learning activities as desired. Teachers working with several students may schedule their time so that students are assigned to a quiet work activity when it is necessary to spend instructional time with one particular student.

Math is a subject that requires skill mastery. But skill mastery needs to be applied toward active student involvement. Measurements require measuring cups, rulers, and empty containers. Boxes and other similar items help the study of solid shapes. Construction paper, beads, buttons, and beans are readily available and can be used for counting, base ten, fractions, sets, grouping, and sequencing. Students should be presented with problem situations and be given the opportunity to find their solutions.

Any workbook assignment that can be supported by a real world experience will enhance the student's ability for problem solving. There is an infinite challenge for the teacher to provide a meaningful environment for the study of math. It is a subject that requires constant assessment of student progress. Do not leave the study of math in the classroom.

This section of the Math Teacher's Guide includes the following teacher aids: Suggested and Required Material (supplies), Additional Learning Activities, Answer Keys, and Alternate LIFEPAC Tests.

The Teacher Notes section of the Teacher's Guide lists the required or suggested materials for the LIFEPACs and provides additional learning activities for the students. Additional learning activities provide opportunities for problem solving, encourage the student's interest in learning and may be used as a reward for good study habits.

MATH 1101

Unit 1: Sets, Structure, and Function

TEACHER NOTES

| MATERIALS NEEDED FOR LIFEPAC	
Required	Suggested
(none)	• straightedges

ADDITIONAL LEARNING ACTIVITIES

Section 1: Sets

1. Discuss the use of Venn diagrams as pictorial representations of relationships involving sets. Illustrate with the following examples.
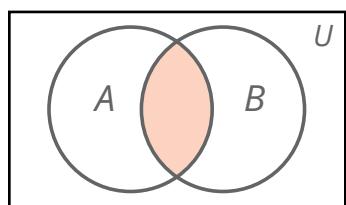
a. $A \cap B$
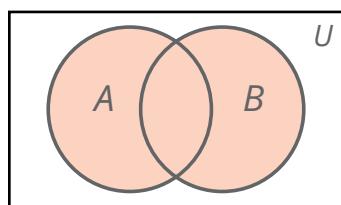
b. $A \cup B$

2. Divide the class into three groups. Each group writes a description of each of the following sets using set notation.

   a. The set *S* of states having a border on the Pacific Ocean.
   b. The set *C* of consonants in the word Mississippi.
   c. The set *F* of numbers between 3 and 21 that are divisible by 4.

   Each group exchanges its answers with the other groups and critiques one another's solutions.

Section 2: Structure

1. Write the following statements on the board and have the students respond with the correct property name. Many other possibilities exist; just change the numbers or variables.

$10 = 10$	reflexive
$5 + 7 = 7 + 5$	commutative—addition
$2(3 \cdot 9) = (2 \cdot 3)9$	associative—multiplication
$22 + 0 = 22$	identity—addition
If $u = v$ and $v = 6$, then $u = 6$.	transitive
$4(2 + 7) = 4 \cdot 2 + 4 \cdot 7$	distributive
$3 \cdot \frac{1}{3} = 1$	multiplicative inverse
If $d = e$, then $e = d$.	symmetric
$8 \cdot 9 = 9 \cdot 8$	commutative—multiplication
$6 \cdot 0 = 0$	zero—multiplication
$4 + (2 + 5) = (4 + 2) + 5$	associative—addition
$3 + (-3) = 0$	additive inverse
$5 \cdot 1 = 5$	identity—multiplication

2. Let groups of two to four students make up their own examples of each of the properties and quiz each other for the correct property name.

Section 3: Relations and Functions

1. Draw the graph for each of the following three functions on one pair of axes. Write each equation along its line.

$$y = x \qquad y = \tfrac{1}{2}x \qquad y = 2x$$

Indicate the symmetry in the differences among the three slopes. Point out the relative steepness of the line $y = 2x$ compared to the other equations.

2. Give the following equations and have the students indicate without drawing the graphs which is the steepest line.

$$y = \tfrac{1}{3}x \qquad y = 3x \qquad y = x$$

3. Have the students draw the graph for each of the following three functions on one pair of axes and write the equation for each one along its line.

$$y = x + 1 \qquad y = x + 4 \qquad y = x + 5$$

Have the students describe the relationship among the lines. Then have them write a formula for another line in the same direction.

Section 4: Algebraic Expressions

1. Explain scientific notation to your class as a useful method for writing very large and very small numbers. Illustrate with these examples:
   a. Convert 465,000 to scientific notation.
   b. Convert 0.000145 to scientific notation.

2. Demonstrate how to easily multiply and divide large numbers that end in zeros. To multiply these numbers, multiply all the numbers except the zeros; count the number of zeros and write them after the product. To divide these numbers, "cancel" as many zeros as possible and then divide. For example, to divide 6,000,000 by 2,000, "cancel" the three zeros at the end of each number and then divide 6,000 by 2. Illustrate with these examples:
   a. Multiply 48,000,000 by 3,000.
   b. Divide 58,000,000 by 2,000.

   To multiply decimals with zeros, multiply all the numbers except the zeros; count the number of zeros after the decimal point and write them before the product. To divide decimals with zeros, move the decimal point to the right the required number of places in the divisor and in the dividend to make the divisor a whole number; divide. Illustrate with these examples:
   a. Multiply 0.0000678 by 0.0015.
   b. Divide 0.00116 by 0.000029.

3. Have each student bring to class any recent news or magazine article in which some form of exponential notation is expressed. Have the student indicate whether he would use another technique for clarification or simplification rather than the exponential notation used in the article.

Additional Activities

The following activities may be reproduced as a student worksheet.

» **FUNCTIONS**

1. Draw a graph for each of these two functions on one pair of axes.

   $f(x) = 2x + 1$ $f(x) = 2x + 3$
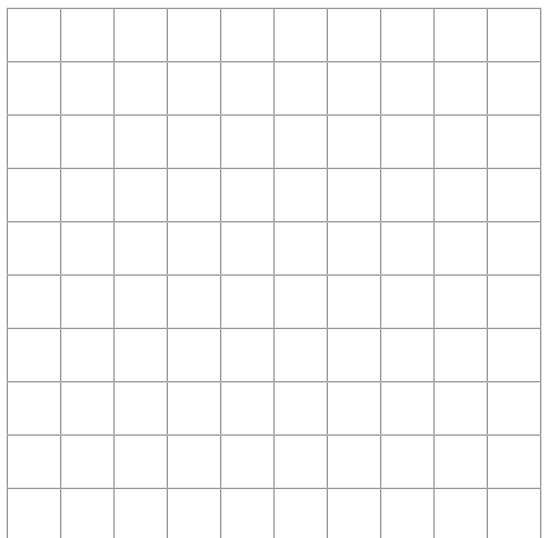
2. Write the equation for the line midway between the two lines.

3. Draw the graph for each of these two functions on one pair of axes.

   $f(x) = x - 4$ $f(x) = 4 - x$

x	0	1	2	3	4	5
$f(x)$	-4	-3	___	___	___	1

   What do you notice about these two lines?

   _____
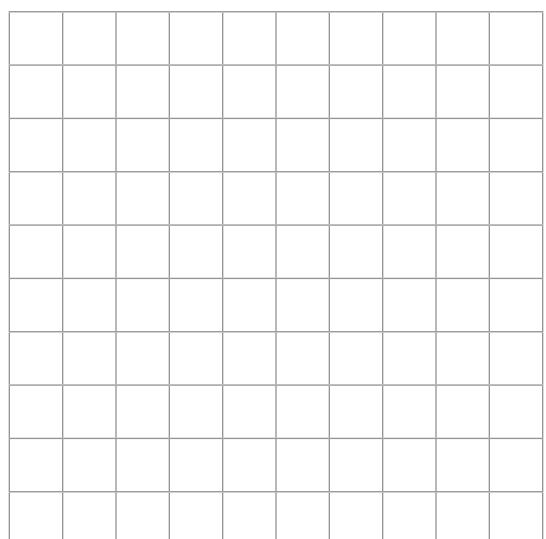
ADDITIONAL ACTIVITY, SOLUTION KEY

1. $f(x) = 2x + 1$

x	0	$-\frac{1}{2}$	-2
$f(x)$	1	0	-3

$f(x) = 2x + 3$

x	0	$-\frac{3}{2}$	2
$f(x)$	3	0	7
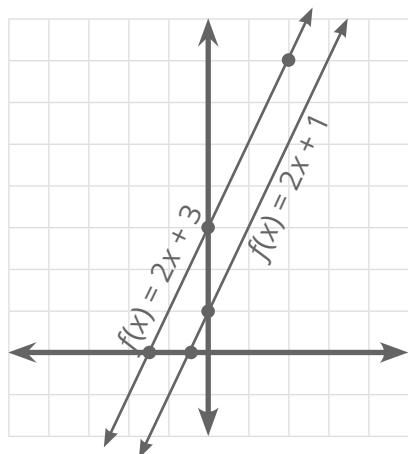
2. $f(x) = \frac{1}{2}(2x + 1 + 2x + 3) =$

$\frac{1}{2}(4x + 4) = 2x + 2$

$f(x) = 2x + 2$

3. $f(x) = x - 4$

x	0	1	2	3	4	5
$f(x)$	-4	-3	-2	-1	0	1

$f(x) = 2 - 4 = -2$
$f(x) = 3 - 4 = -1$
$f(x) = 4 - 4 = 0$

$f(x) = 4 - x$

x	0	1	2	3	4	5
$f(x)$	4	3	2	1	0	-1
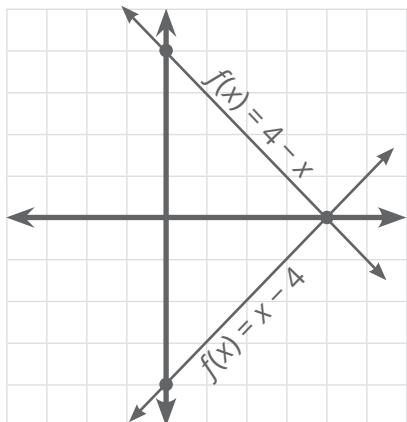
The two lines are perpendicular.

ANSWER KEY

SECTION 1

1.1	{3, 5, 7, 9, 11, 13}	**1.30**	{1}, {2}, {3}, {4}
1.2	{6, 4, 2, 0}	**1.31**	{1, 2}, {1, 3}, {1, 4}, {2, 3}, {2, 4}, {3, 4}
1.3	{1, 4, 9, 16, 25, 36, 49, 64}	**1.32**	{1, 2, 3}, {1, 2, 4}, {1, 3, 4}, {2, 3, 4}
1.4	answers will vary; example: {Jones, Tate, Marsh}	**1.33**	{1, 2, 3, 4}
1.5	{13, 26, 39}	**1.34**	16
1.6	$A = \{x \mid x$ is an even whole number between 0 and 13}	**1.35**	32
1.7	$A = \{x \mid x$ is a perfect cube number between 0 and 100}	**1.36**	2^n where n = number of elements in the set
		1.37	{1, 2, 3, 4, 5, 6}
1.8	$A = \{x \mid x$ is a letter in the word *algebra*}	**1.38**	{1, 2, 3, 4, 5}
1.9	$A = \{x \mid x$ is an even number between 0 and 8}	**1.39**	{1, 2, 3, 4, 5, 6}
1.10	$A = \{x \mid x$ is a whole number less than 1}	**1.40**	{2, 4}
1.11	=	**1.41**	{1, 3, 5}
1.12	≠	**1.42**	Ø
1.13	≠; {0} has one element, { } has none	**1.43**	{1, 2, 3, 4, 5, 6}
1.14	=	**1.44**	Ø
1.15	≠	**1.45**	{1, 2, 3, 4, 5}
1.16	3	**1.46**	{1, 2, 3, 4, 5}
1.17	1	**1.47**	set of all whole numbers
1.18	0	**1.48**	set of all whole numbers
1.19	answers will vary	**1.49**	{1, 4, 9, 16, 25, 36, 49, 64, 81, 12, 14, 18}
1.20	11	**1.50**	{1, 4, 9, 16, 25, 36, 49, 64, 81}
1.21	8	**1.51**	{12, 14, 16, 18}
1.22	6	**1.52**	{16}
1.23	⊂	**1.53**	{all whole numbers}
1.24	⊂	**1.54**	{16}
1.25	=	**1.55**	{all whole numbers}
1.26	{*a*}, {*b*}, {*c*}	**1.56**	{1, 4, 9, 16, 25, 36, 49, 64, 81, 12, 14, 18}
1.27	{*a, b*}, {*a, c*}, {*b, c*}	**1.57**	c
1.28	{*a, b, c*}	**1.58**	e
1.29	8	**1.59**	d
		1.60	a
		1.61	b

SELF TEST 1

1.01 true
1.02 true
1.03 $A = B$
1.04 {a}, {b}, {c}, {a, b}, {a, c}, {b, c}, {a, b, c}, Ø
1.05 $2^n = 2^6 = 64$
1.06 {$x : x$ is an integer and $0 < x \leq 10$}
or {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
1.07 Ø
1.08 {1, 3, 5, 6, 7, 9}
1.09 {1, 5, 7, 9}
1.010 Ø

SECTION 2

2.1 d
2.2 a
2.3 k
2.4 l
2.5 g
2.6 h
2.7 e
2.8 b
2.9 f
2.10 i
2.11 j
2.12 c
2.13 associative—addition
2.14 associative—addition and identity—addition
2.15 associative—multiplication
2.16 commutative—addition and
associative—addition
2.17 commutative—multiplication and
associative—multiplication
2.18 associative—multiplication
2.19 commutative multiplication used twice
2.20 800 + 24 = 824
2.21 240 + 24 = 264
2.22 9(30 + 3) = 270 + 27 = 297
2.23 13(10 + 2) = 130 + 26 = 156
2.24 17(10 − 1) = 170 − 17 = 153
2.25 22(20 + 3) = 440 + 66 = 506
2.26 2 + 3 • 6 = 2 + 18 = 20
2.27 18 − 5 • 3 = 18 − 15 = 3
2.28 4 • 6 + 3 • 8 = 24 + 24 = 48
2.29 6 • 2 ÷ 6 + 1 = 12 ÷ 6 + 1 = 2 + 1 = 3
2.30 10 ÷ 5 + 6 ÷ 3 = 2 + 2 = 4
2.31 5(4 • 3 + 3 • 4) = 5(12 + 12) = 5(24) = 120
2.32 8 − 2 • 2 = 8 − 4 = 4
2.33 (16 + 0) • 0 = 16 • 0 = 0
2.34 $\frac{1}{2}$ • 8 + $\frac{1}{3}$ • 12 ÷ 2 = 4 + $\frac{4}{2}$ = 4 + 2 = 6
2.35 5(2 + 3) ÷ 25 + 8 ÷ 4 =
5(5) ÷ 25 + 2 = 1 + 2 = 3
2.36 3 + 4 ÷ 2 + 6(9 − 3) ÷ 12 + 1 =
3 + 2 + $\frac{36}{12}$ + 1 =
3 + 2 + 3 + 1 =
9
2.37 8 + [13 − (2 + 1)] =
8 + [10] =
18
2.38 5(5 + 2) − 2(5 − 4) =
5(7) − 2(1) =
35 − 2 =
33

2.39   4[(6 − 1) + 3(5 − 2)] =
          4[5 + 9] =
          4 • 14 =
          56

2.40   2[3 + 5(1 + 2)] =
          2[3 + 15] =
          2[18] =
          36

SELF TEST 2

2.01   10 + 4(3 + 2) + 5 + 12 ÷ 6
          = 10 + 20 + 5 + 2
          = 37

2.02   commutative—multiplication

2.03   commutative and associative for addition

2.04   symmetric

2.05   3{5 + 3[10 + (4 • 8)]}
          = 3{5 + 3[42]}
          = 3{5 + 126}
          = 3{131}
          = 393

2.06   {1}, {3}, {5}, {1, 3}, {1, 5}, {3, 5}, {1, 3, 5}, Ø

2.07 $2^n = 2^8 = 256$

2.08 $A \cup B = \{1, 2, 3, 4, 5, 6\}$

2.09 $A \cap C = A = \{1, 3, 5\}$

2.010 Ø

SECTION 3

3.1 neither: not a set of paired numbers
3.2 function
3.3 relation
3.4 function
3.5 function
3.6 function
3.7 {2}
3.8 {3, 4, 5, 6}
3.9 domain = range = {set of all real numbers}
3.10 domain = {all real numbers}
range = $\{y : y \geq 0\}$

3.11
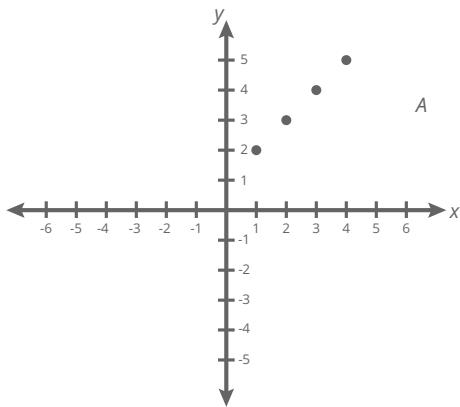
3.12
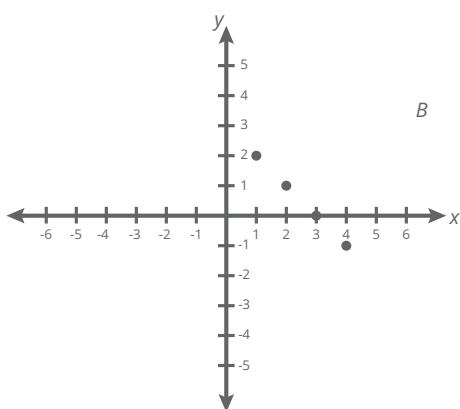
3.13
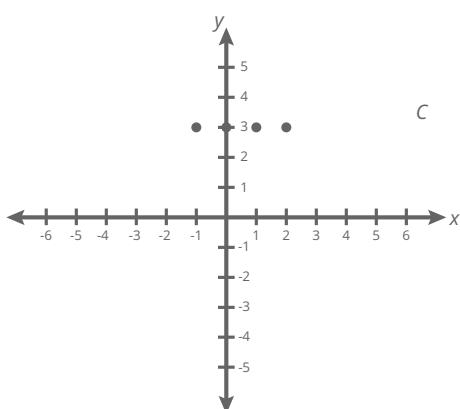
3.14
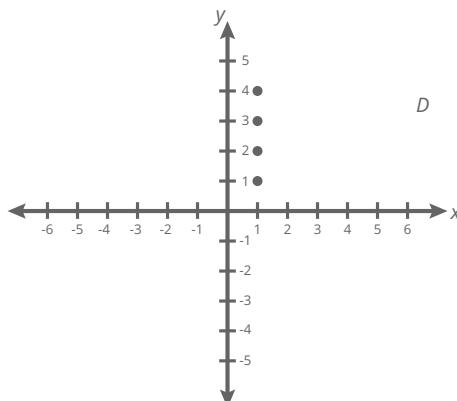
3.15
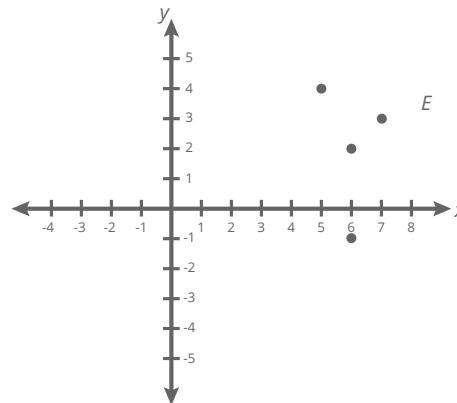
3.16 *D* and *E*, Problems 3.14 and 3.15 (vertical-line test)

3.17 Use $x = 0, 2, 4$.
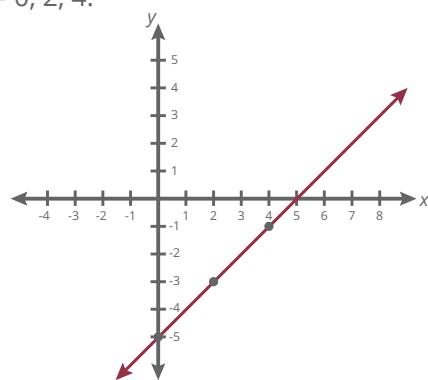
3.18 yes
3.19 yes
3.20 no
3.21 $f(x) = x^2 + 1$
$f(2) = 2^2 + 1 = 4 + 1 = 5$
3.22 $f(x) = x^2 + 1$
$f(6) = 6^2 + 1 = 36 + 1 = 37$
3.23 $f(x) = x^2 + 1$
$f(-1) = (-1)^2 + 1 = 1 + 1 = 2$

3.24 $f(x) = x^2 + 1$
$f(-6) = (-6)^2 + 1 = 36 + 1 = 37$

3.25 $f(x) = x^2 + 1$
$f(10) = 10^2 + 1 = 100 + 1 = 101$

3.26 $g(x) = 3x + 1$
$g(3) = 3 \cdot 3 + 1 = 9 + 1 = 10$

3.27 $g(x) = 3x + 1$
$g(-2) = 3(-2) + 1 = -6 + 1 = -5$

3.28 $g(x) = 3x + 1$
$g(0) = 3 \cdot 0 + 1 = 0 + 1 = 1$

3.29 $g(x) = 3x + 1$
$g(-14) = 3(-14) + 1 = -42 + 1 = -41$

3.30 $g(x) = 3x + 1$
$g(22) = 3(22) + 1 = 66 + 1 = 67$

3.31 $f(2) + g(3) = 5 + 10 = 15$

3.32 $f(5) = 5^2 + 1 = 26$
$g(1) = 3(1) + 1 = 4$
$f(5) - g(1) = 26 - 4 = 22$

3.33 $g(20) = 3(20) + 1 = 61$
$f(6) = 6^2 + 1 = 37$
$g(20) + f(6) = 61 + 37 = 98$

3.34 $f(3) = 3^2 + 1 = 10$
$g(-2) = 3(-2) + 1 = -5$
$[f(3) + g\{-2\}]^2 = [10 - 5]^2 = 25$

3.35 $f(-1) = (-1)^2 + 1 = 2$
$g(-3) = 3(-3) + 1 = -8$
$2 + 5(-8) = 2 - 40 = -38$

3.36 $f(2) = 2^2 + 1 = 5$
$g(10) = 3(10) + 1 = 31$
$[f(2) + g(10)] \div 12 = [5 + 31] \div 12 = 3$

3.37 $f(4) = 4^2 + 1 = 17$
$2f(4) = 2(17) = 34$

3.38 $g(5) = 3(5) + 1 = 16$
$3g(5) = 3(16) = 48$

3.39 $f(4) = 4^2 + 1 = 17$
$[f(4)]^2 = 17^2 = 289$

3.40 $g(1) = 3 \cdot 1 + 1 = 4$
$[g(1)]^3 = 4^3 = 64$

3.41 $f(1) = 1^2 + 1 = 2$
$g(4) = 3 \cdot 4 + 1 = 13$
$2f(1) + 3g(4) = 2(2) + 3(13) =$
$4 + 39 = 43$

3.42 $f(3) = 3^2 + 1 = 10$
$g(5) = 3 \cdot 5 + 1 = 16$
$[f(3)]^2 + g(5) = 10^2 + 16 = 116$

3.43 $f(2) = 2^2 + 1 = 5$
$g(1) = 3 \cdot 1 + 1 = 4$
$[f(2) - g(1)]^2 = (5 - 4)^2 = 1^2 = 1$

3.44 $[f(6)]^2 - [g(3)]^2 = 37^2 - 10^2 = 1{,}269$

3.45 $10f(101) - 10g(31)$
$10(101^2 + 1) - 10(31 \cdot 3 + 1)$
$10(10{,}202) - 10(94)$
$102{,}020 - 940$
$101{,}080$

3.46 $F(x) = 3x + 1$
$F(a) = 3 \cdot a + 1 = 3a + 1$

3.47 $F(x) = 3x + 1$
$F(a + 1) = 3(a + 1) + 1 =$
$3a + 3 + 1 = 3a + 4$

3.48 $F(x) = 3x + 1$
$F(a + h) = 3(a + h) + 1 =$
$3a + 3h + 1$

3.49 $F(x) = 3x + 1$
$F(a + h) = 3a + 3h + 1$
$F(a) = 3a + 1$
$F(a + h) - F(a) =$
$3a + 3h + 1 - (3a + 1) = 3h$

3.50 $\dfrac{F(a + h) - F(a)}{h} = \dfrac{3h}{h} = 3$

3.51 $f(x) = 3x + 1$
$f(2) = 3 \cdot 2 + 1 = 7$

3.52 $f^{-1}(x) = \dfrac{x - 1}{3}$
$f^{-1}(7) = \dfrac{7 - 1}{3} = 2$

3.53 $f(x) = 3x + 1$
$f(3) = 3 \cdot 3 + 1 = 10$

3.54 $f^{-1}(x) = \dfrac{x - 1}{3}$
$f^{-1}(10) = \dfrac{10 - 1}{3} = 3$

3.55 $f(0) = 3 \cdot 0 + 1 = 1$

3.56 $f^{-1}(1) = \dfrac{1 - 1}{3} = 0$

3.57 $(x, f(x)) = (2, 7)$
3.58 $(x, f^{-1}(x)) = (7, 2)$
3.59 $(x, f(x)) = (3, 10)$
3.60 $(x, f^{-1}(x)) = (10, 3)$
3.61 $(x, f(x)) = (0, 1)$
3.62 $(x, f^{-1}(x)) = (1, 0)$
3.63 yes

SELF TEST 3

3.01 {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11}
3.02 finite
3.03 a. $B \cap C$ = {3, 4, 5}
 b. $B \cup C$ = {l, 2, 3, 4, 5, 6, 7}
3.04 {A}, {B}, {C}, {D}, {A, B}, {A, C},
 {A, D}, {B, C}, {B, D}, {C, D},
 {A, B, C}, {A, B, D}, {A, C, D},
 {B, C, D}, {A, B, C, D}, Ø
3.05 6
3.06 true
3.07 false
3.08 true
3.09 false
3.010 true
3.011 commutative—addition
3.012 distributive
3.013 associative—addition
3.014 additive—identity
3.015 Symmetric
3.016 $3 + 2 \cdot 8 \div 4$
 $= 3 + 16 \div 4$
 $= 3 + 4$
 $= 7$
3.017 $[3(5 + 6) + 2] \div 7$
 $= [3(11) + 2] \div 7$
 $= [35] \div 7$
 $= 5$
3.018 $F(x) = x^2 + 2$
 $F(2) = 2^2 + 2 = 6$
3.019 $G(x) = 3x + 1$
 $G(-1) = 3(-1) + 1 = -3 + 1 = -2$
3.020 $H(x) = x$
 $H(5) = 5$
3.021 $F(1) + F(5) = 1^2 + 2 + 5^2 + 2 =$
 $3 + 27 = 30$
3.022 $F(2) − F(8) + G(1)$
 $2^2 + 2 − (8^2 + 2) + 3 \cdot 1 + 1$
 $4 + 2 − 66 + 3 + 1$
 -56
3.023 $F(a) + G(a) + H(a)$
 $a^2 + 2 + 3 \cdot a + 1 + a$
 $a^2 + 4a + 3$
3.024 domain = {1, 2, 3, 4, 5}
3.025 range = {2, 3, 7}
3.026 P^{-1} = {(2, 1), (2, 2), (3, 3), (3, 4), (7, 5)}

SECTION 4

4.1 6^3
4.2 7^4
4.3 x^2
4.4 $(3a)^3$
4.5 r^5
4.6 $(8y)^3$
4.7 5^3b^4
4.8 10^2a^2b
4.9 $4^3a^2b^2$
4.10 $5^2 = 5 \cdot 5$
4.11 $(-2)^3 = (-2)(-2)(-2)$
4.12 $(ab)^4 = ab \cdot ab \cdot ab \cdot ab$
4.13 $10^4 = 10 \cdot 10 \cdot 10 \cdot 10$
4.14 $(-a)^3 = (-a)(-a)(-a)$
4.15 $(2c)^5 = (2c)(2c)(2c)(2c)(2c)$
4.16 $(3x)^2 = (3x)(3x)$
4.17 $(-3x)^4 = (-3x)(-3x)(-3x)(-3x)$
4.18 $8^3 = 8 \cdot 8 \cdot 8$
4.19 $2^0 = 1$
4.20 $6^{-1} = \frac{1}{6}$
4.21 $6^{-3} = \frac{1}{6^3} = \frac{1}{216}$
4.22 $(a + b)^0 = 1$
4.23 $3^1 = 3$
4.24 $8^{-1} = \frac{1}{8}$
4.25 $\frac{1}{10^0} = \frac{1}{1} = 1$
4.26 $(xy)^0 = 1$
4.27 $(5x)^0 = 1$
4.28 $2^{-2} = \frac{1}{2^2} = \frac{1}{4}$
4.29 $\frac{5^{-1}}{5^0} = \frac{\frac{1}{5}}{1} = \frac{1}{5}$
4.30 $(-7)^{-1} = \frac{1}{-7} = -\frac{1}{7}$
4.31 $\frac{1}{3^2} = 3^{-2}$
4.32 $\frac{1}{(xy)} = (xy)^{-1}$
4.33 $\frac{1}{a^4} = a^{-4}$
4.34 $\frac{1}{8^6} = 8^{-6}$
4.35 $\frac{5}{x^2} = 5x^{-2}$
4.36 $\frac{1}{16^2} = 16^{-2}$
4.37 $x^2 \cdot x^5 = x^{2 + 5} = x^7$
4.38 $r^2 \cdot r \cdot r^5 = r^{2 + 1 + 5} = r^8$
4.39 $\frac{x^{10}}{x^4} = x^{10 - 4} = x^6$
4.40 $\frac{(a + b)^9}{(a + b)^4} = (a + b)^{9 - 4} = (a + b)^5$

4.41 $\dfrac{10x^5}{2x^2} = 5x^{5-2} = 5x^3$

4.42 $\dfrac{3.6x^5}{1.2x^2} = 3x^{5-2} = 3x^3$

4.43 $y^7 \cdot y^9 = y^{7+9} = y^{16}$

4.44 $2x \cdot 3x^2 = 6x^3$

4.45 $\dfrac{a^5}{a} = a^{5-1} = a^4$

4.46 $\dfrac{(3x)^{12}}{(3x)^4} = (3x)^{12-4} = (3x)^8$

4.47 $\dfrac{15a^4}{3a^2} = 5a^{4-2} = 5a^2$

4.48 $\dfrac{0.105p^6}{0.5p^3} = 0.21p^{6-3} = 0.21p^3$

4.49 $p^3 \cdot p^2 \cdot p = p^{3+2+1} = p^6$

4.50 $5a^2 \cdot 6a^4 = 30a^{2+4} = 30a^6$

4.51 $\dfrac{b^7}{b^6} = b^{7-6} = b^1$ or b

4.52 $\dfrac{a^5}{a^3} = a^{5-3} = a^2$

4.53 $\dfrac{20b^2c^3}{4bc} = 5b^{2-1}\,c^{3-1} = 5bc^2$

4.54 $\dfrac{7.2q^4r^5}{0.6q^3r^3} = 12q^{4-3}r^{5-3} = 12qr^2$

4.55 $x^4 \cdot x^{-2} = x^{4-2} = x^2$

4.56 $p^8 \cdot p^{-3} \cdot p^2 = p^{8-3+2} = p^7$

4.57 $\dfrac{x^5}{x^{-3}} = x^{5-(-3)} = x^{5+3} = x^8$

4.58 $\dfrac{a^3b^2}{a^{-1}b^{-3}} = a^{3+1}b^{2+3} = a^4b^5$

4.59 $x^{-3}x^7 = x^{7-3} = x^4$

4.60 $y^{-9}y^{-8}y^{10} = y^{10-9-8} = y^{-7}$

4.61 $\dfrac{x^{-8}}{x^{-7}} = x^{-8+7} = x^{-1}$

4.62 $\dfrac{p^{-4}q^5r^6}{p^{-3}qr^{-2}} = p^{-4+3}q^{5-1}r^{6+2} = p^{-1}q^4r^8$

4.63 $x^{-8} \cdot x^{-2} = x^{-8-2} = x^{-10}$

4.64 $b^3 \cdot b^{-3} = b^{3-3} = b^0 = 1$

4.65 $\dfrac{x^{-8}}{x^5} = x^{-8-5} = x^{-13}$

4.66 $\dfrac{10}{10^{-2}} = 10^{1+2} = 10^3 = 1{,}000$

4.67 $(x^2)^4 = x^{2\cdot4} = x^8$

4.68 $(r^3)^{-2} = r^{-6}$

4.69 $(a^2b^2)^3 = a^6b^6$

4.70 6^{-9}

4.71 $x^4y^6z^8$

4.72 $2^3a^6 = 8a^6$

4.73 $(-5)^3x^{2\cdot3} = -125x^6$

4.74 x^{10}

4.75 8^{-9}

4.76 $x^{12}y^6$

4.77 $\dfrac{1}{x^{-8}} = x^8$

4.78 $a^{-2}b^{-4}c^{-6}$

4.79 $3^4b^{12} = 81b^{12}$

4.80 $(-4)^2x^4 = 16x^4$

4.81 p^8

4.82 t^{-72}

4.83 $x^{12}y^6$

4.84 $\dfrac{1}{y^{-12}} = y^{12}$

4.85 $r^{-12}s^8t^4$

4.86 $4^3c^6 = 64c^6$

4.87 $3^2a^4b^2 = 9a^4b^2$

4.88 $5x + 3x = (5+3)x = 8x$

4.89 $8x^2 - 2x^2 = (8-2)x^2 = 6x^2$

4.90 $3a + 3a - 2a = (3+3-2)a = 4a$

4.91 $11x^2 - y$

4.92 $5x + 9y$

4.93 $3x$

4.94 $6b^3$

4.95 $8a$

4.96 $3x + y$

4.97 $9x + 3y$

4.98 $23a$

4.99 $2x$

4.100 $-2b$

4.101 $9x - 6y$

4.102 $7x + 3y$

4.103 $2x + 3y$

4.104 $6ab$

4.105 $7ab + 5$

4.106 $2x + y - 1$

4.107 $11xy$

4.108 $6x^2y - 4xy^2$

4.109 $14a - 13b$

4.110 $12abc$

4.111 $4p^2q^2$

4.112 $5(x-2) + 6$
$= 5x - 10 + 6$
$= 5x - 4$

4.113 $7(x+6) - 4$
$= 7x + 42 - 4$
$= 7x + 38$

4.114 $15(2-x) + 17x$
$= 30 - 15x + 17x$
$= 30 + 2x$

4.115 $7(x+2) + 3(x+1)$
$= 7x + 14 + 3x + 3$
$= 10x + 17$

4.116 $8(x + 3) - 2x$
$= 8x + 24 - 2x$
$= 6x + 24$

4.117 $10(x - 5) + 20$
$= 10x - 50 + 20$
$= 10x - 30$

4.118 $13 - 3(5 - 2x)$
$= 13 - 15 + 6x$
$= 6x - 2$

4.119 $10(x + 4) + 15(x + 1)$
$= 10x + 40 + 15x + 15$
$= 25x + 55$

4.120 $13(x - 2) + 5(x + 1)$
$= 13x - 26 + 5x + 5$
$= 18x - 21$

4.121 $8(2x + 2) + 5(3x - 1)$
$= 16x + 16 + 15x - 5$
$= 31x + 11$

4.122 $7(9x - 3) - 4(2x - 1)$
$= 63x - 21 - 8x + 4$
$= 55x - 17$

4.123 $10(7 - 2x) + 4(3 - x)$
$= 70 - 20x + 12 - 4x$
$= 82 - 24x$

4.124 $2(x + 1) + 2(x + 2) + 3(x - 1)$
$= 2x + 2 + 2x + 4 + 3x - 3$
$= 7x + 3$

4.125 $3(1 - 2x) + 2(x - 1) - 3(x - 4)$
$= 3 - 6x + 2x - 2 - 3x + 12$
$= 13 - 7x$

4.126 $2(x^2 - 1) + 3(x^2 + 1)$
$= 2x^2 - 2 + 3x^2 + 3$
$= 5x^2 + 1$

4.127 $6(x - 3) - 4(x + 1)$
$= 6x - 18 - 4x - 4$
$= 2x - 22$

4.128 $4(5x - 6) - 4(2x + 1)$
$= 20x - 24 - 8x - 4$
$= 12x - 28$

4.129 $4(6 - 2x) - 3(3 - 4x)$
$= 24 - 8x - 9 + 12x$
$= 4x + 15$

4.130 $20(1 - 2x) + 4(7 - 2x)$
$= 20 - 40x + 28 - 8x$
$= 48 - 48x$

4.131 $7(x - 1) - 2(x + 1) + 3(x - 4)$
$= 7x - 7 - 2x - 2 + 3x - 12$
$= 8x - 21$

4.132 $5(a - b) + 6(a + b) - 7(a - 2b)$
$= 5a - 5b + 6a + 6b - 7a + 14b$
$= 4a + 15b$

4.133 $5(a^3 - 2) + 6(a^3 - 4)$
$= 5a^3 - 10 + 6a^3 - 24$
$= 11a^3 - 34$

SELF TEST 4

4.01 $A = \{-6, -5, -4, -3, -2, -1\}$

4.02 $A = \{x \mid x$ is a whole number multiple of 3 that is less than 27\}

4.03 $2^n = 2^5 = 32$

4.04 $A \cup B = \{a, e, i, o, u, l, g, b, r\}$

4.05 $A \cap B = \{a, e\}$

4.06 $B \cup C = \{a, l, g, e, b, r, m, t, h\}$

4.07 $B \cap C = \{a\}$

4.08 $A \cup C = \{a, e, i, o, u, m, t, h\}$

4.09 $A \cap C = \{a\}$

4.010 $A \cap B \cap C = \{a\}$

4.011 $7 \cdot 5 + 12 \div 4 = 35 + 3 = 38$

4.012 $8 + 3 \cdot 4 \div 6 = 8 + \frac{12}{6} = 8 + 2 = 1$

4.013 $F(x) = 2x^2 - 3$
$F(-2) = 2(-2)^2 - 3 = 2 \cdot 4 - 3 =$
$8 - 3 = 5$

4.014 $f(x) = 3x - 1$
$f(-2) = 3(-2) - 1 = -7$
$g(x) = -x + 6$
$g(5) = -5 + 6 = 1$
$f(-2) + g(5) = -7 + 1 = -6$

4.015 $\{-1, -8, 0, 6\}$

4.016 $\{7, 2, 0, 6\}$

4.017 $F(x) = x^2$
range of $F(x) \geq 0$

4.018 $h(p) = p^2 - 3p + q$
$h(x) = x^2 - 3x + q$

4.019 $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

4.020 $(2x^2) = 2 \cdot x \cdot x$

4.021 $(3a^2)^3 = 3^3 a^6 = 27 a^6$

4.022 $(-2x^3)$
$-2(-2)^3 = -2(-8) = 16$

4.023 $6^0 + 6^1 + 6^2 = 1 + 6 + 36 = 43$

4.024 true

4.025 true

4.026 false

4.027 false

4.028 true

4.029 false

4.030 true

4.031 false

4.032 true

4.033 true

4.034 true

4.035 true

4.036 false

4.037 true; $\frac{1}{5^{-2}} = 5^2 = 25$

4.038 false

4.039 $\frac{32a^3 b^2}{8ab^2} = 4a^2$

4.040 $48x^2(16x)^{-1} = \frac{48x^2}{16x} = 3x$

4.041 $x^5 \cdot x^{-5} \cdot x^2 = x^{0+2} = x^2$

4.042 $3(x + 2) - 4x$
$= 3x + 6 - 4x$
$= -x + 6$

4.043 $5(2x - 3) + 4(x + 1)$
$= 10x - 15 + 4x + 4$
$= 14x - 11$

4.044 $5(x + y) + 3(x - y)$
$= 5x + 5y + 3x - 3y$
$= 8x + 2y$

4.045 $3x^2 + 2x + 4 - x^2 + 5x$
$= 2x^2 + 7x + 4$

LIFEPAC TEST

1. $K \cup G = \{\bigcirc, \square, \triangle, \mathrm{I}, \diagdown\}$
2. $K \cap H = \{\square\}$
3. $K \cap G \cap H = \{\ \} = \emptyset$
4. $\{\square\}, \{\boxtimes\}, \{\otimes\}, \{\square, \boxtimes\}, \{\square, \otimes\}, \{\boxtimes, \otimes\},$
   $\{\square, \boxtimes, \otimes\}, \emptyset$
5. $2^n = 2^6 = 64$
6. 7
7. $12 + 8 \div 2 + 10 = 12 + 4 + 10 = 26$
8. $15 \div 3 + 10 \div 2 = 5 + 5 = 10$
9. associative—addition and commutative—addition
10. multiplicative inverse
11. multiplicative inverse, additive and multiplicative inverse, commutative (addition and multiplication), associative (addition and multiplication)
12. commutative—addition and multiplication
13. range = {1, 2, 3, 7}
14. domain = {5, 6, 7, 8, 9}
15. no: double-valued points, (1, 5) and (1, 8)
16. $f(x) = x^2 + 5x$
    $f(-2) = (-2)^2 + 5(-2) = 4 - 10 = -6$
17. $g(x) = 2x + 1$
    $g(3) = 2 \cdot 3 + 1 = 6 + 1 = 7$
18. $f(5) + g(6) = 5^2 + 5(5) + 2(6) + 1 = 50 + 13 = 63$
19. $g(3) - f(4) = 2(3) + 1 - (4^2 + 5 \cdot 4) = 7 - 36 = -29$
20. $g(a + h) - g(a)$
    $= 2(a + h) + 1 - (2a + 1)$
    $= 2a + 2h + 1 - 2a - 1$
    $= 2h$

21. a^3
22. $(3b)^4 = 81b^4$
23. $2a^2b^2$
24. $3 \cdot x \cdot x$
25. $3a \cdot 3a \cdot 3a$
26. $abc \cdot abc$
27. $10^2 \cdot 10^3 = 10^{2+3} = 10^5$
28. $x^3x^5 = x^{3+5} = x^8$
29. $a^2 \cdot a^{-3} \cdot a = a^{2-3+1} = a^0 = 1$
30. $\dfrac{18a^3b^2}{2ab} = 9a^2b$
31. $\dfrac{12ab^3c^2}{4a^{-2}bc^{-2}} = 3a^{1+2}b^{3-1}c^{2+2} = 3a^3b^2c^4$
32. 8
33. $3^{-2} = \dfrac{1}{3^2} = \dfrac{1}{9}$
34. $7^0 = 1$
35. $5h - 2h = (5 - 2)h = 3h$
36. $2a$
37. $7x^2 + 3x$
38. $5(x - 2) + 3x$
    $= 5x - 10 + 3x$
    $= 8x - 10$
39. $7 - 2(5 - 2x)$
    $= 7 - 10 + 4x$
    $= -3 + 4x \ \text{ or } \ 4x - 3$
40. $3(x + 2) + 4(x - 5)$
    $= 3x + 6 + 4x - 20$
    $= 7x - 14$

ALTERNATE LIFEPAC TEST

1. {a, b, c, d, e, k, m, o}
2. { } or Ø
3. $A \cap B$ = {a, e}
   $A \cap B \cup C$ = {a, e, k, m, o}
4. {k}, {m}, {o}, {k, m},
   {k, o}, {m, o}, {k, m, o}, Ø
5. 8 elements are in $A \cup C$; therefore, the number of subsets is 2^8 = 256.
6. 0
7. 16 + 12 ÷ 3 − 10 =
   16 + 4 − 10 =
   10
8. 22 ÷ 11 + 9 ÷ 3 =
   2 + 3 =
   5
9. associative—addition and commutative—addition
10. multiplicative inverse
11. multiplicative inverse and additive inverse
12. distributive
13. {-7, -1, 1, 2}
14. {-2, 3, 4, 6}
15. F^{-1} = {(2, 6), (1, 3), (-7, 4), (-1, -2)}
    yes
16. $F(-2) = (-2)^2 − 24$
    $= 4 − 24$
    $= -20$
17. $G(3) = 54 − 2(3)$
    $= 54 − 6$
    $= 48$
18. $F(5) = 5^2 − 24$
    $= 25 − 24$
    $= 1$
    $G(6) = 54 − 2(6)$
    $= 54 − 12$
    $= 42$
    $F(5) + G(6) = 1 + 42$
    $= 43$
19. $G(2) = 54 − 2(2)$
    $= 54 − 4$
    $= 50$
    $F(7) = 54 − 2(7)$
    $= 54 − 14$
    $= 40$
    $G(2) − F(7) = 50 − 40$
    $= 10$
20. $G(a + h) = 54 − 2(a + h)$
    $= 54 − 2a − 2h$
    $G(a) = 54 − 2(a)$
    $= 54 − 2a$
    $G(a + h) − G(a) = 54 − 2a − 2h − (54 − 2a)$
    $= 54 − 2a − 2h − 54 + 2a$
    $= -2h$
21. x^4
22. $2^3 x^3 = 8x^3$
23. $15x^2 y$
24. $5 \cdot x \cdot x \cdot x$
25. $2x \cdot 2x \cdot 2x$
26. $xyz \cdot xyz$ or $x \cdot x \cdot y \cdot y \cdot z \cdot z$
27. $5^2 \cdot 5^4 = 5^{2 + 4} = 5^6$
28. $a \cdot a^2 \cdot a^4 = a^{1 + 2 + 4} = a^7$
29. $x^3 \cdot x^{-3} \cdot x^2 = x^{3 − 3 + 2} = x^2$
30. $\dfrac{12x^2 y^3}{4xy} = (12 ÷ 4)x^{2 − 1}y^{3 − 1} = 3xy^2$
31. $\dfrac{27a^3 b^2 c}{3a^{-2}bc^{-1}} = (27 ÷ 3)a^{3 − (-2)} \cdot b^{2 − 1} \cdot c^{1 − (-1)} = 9a^5 bc^2$
32. $3^3 = 3 \cdot 3 \cdot 3 = 27$
33. $5^{-2} = \dfrac{1}{5^2} = \dfrac{1}{25}$
34. $6^0 = 1$
35. $3x$
36. $10y$
37. $2x^2 − 3x − x^2 − 5x =$
    $2x^2 − x^2 − 3x − 5x =$
    $x^2 − 8x$
38. $4(2x − 3) + 7x =$
    $8x − 12 + 7x =$
    $15x − 12$
39. $8 − 2(x + 6) + x =$
    $8 − 2x − 12 + x =$
    $-x − 4$
40. $7(x − 3) + 3(x + 2) =$
 $7x − 21 + 3x + 6 =$
    $10x − 15$

MATH 1101

ALTERNATE LIFEPAC TEST

106
―――
133

NAME _____

DATE _____

SCORE _____
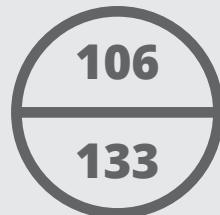
Complete these activities (each answer, 4 points).

Given A = {a, b, c, d, e}, B = {a, e, i, o, u}, C = {k, m, o}

1. $A \cup C$ _____

2. $A \cap C$ _____

3. $A \cap B \cup C$ _____

4. All subsets of C _____

5. Number of subsets of $A \cup C$ _____

6. Number of elements of $A \cap B \cap C$ _____

Evaluate each expression (each question, 3 points).

7. $16 + 12 \div 3 - 10$ _____

8. $22 \div 11 + 9 \div 3$ _____

Name the axiom(s) that justifies each of the following statements (each answer, 2 points).

9. $6 + (x - 3) = x + 3$ _____

10. $A \cdot \frac{1}{A} = 1$ _____

11. $6 \cdot \frac{1}{6} + 2 + (-1) = 2$ _____

12. $6x + 7x = 13x$ _____

Complete these activities (each answer, 3 points).

Given F = {(6, 2), (3, 1), (4, -7), (-2, -1)}

13. Write the range set of F. _____

14. Write the domain set of F. _____

15. Is F^{-1} a function? _____

Complete these activities (each answer, 4 points).

Given $F(x) = x^2 - 24$ and $G(x) = 54 - 2x$

16. $F(-2)$ _____

17. $G(3)$ _____

18. $F(5) + G(6)$ _____

19. $G(2) - F(7)$ _____

20. $G(a + h) - G(a)$ _____

Write each expression in exponential notation (each answer, 3 points).

21. $x \cdot x \cdot x \cdot x$ _____

22. $2x \cdot 2x \cdot 2x$ _____

23. $5 \cdot x \cdot y \cdot x \cdot 3$ _____

Write each expression without exponents (each answer, 3 points).

24. $5x^3$ _____

25. $(2x)^3$ _____

26. $(xyz)^2$ _____

Express in simplified exponential notation (each answer, 3 points).

27. $5^2 \cdot 5^4$ _____

28. $a \cdot a^2 \cdot a^4$ _____

29. $x^3 \cdot x^{-3} \cdot x^2$ _____

30. $\dfrac{12x^2y^3}{4xy}$ _____

31. $\dfrac{27a^3b^2c}{3a^{-2}bc^{-1}}$ _____

Evaluate each expression (each answer, 3 points).

32. 3^3 _____

33. 5^{-2} _____

34. 6^0 _____

Combine like terms (each answer, 4 points).

35. $6x - 3x$ _____

36. $5y + 7y - 2y$ _____

37. $2x^2 - 3x - x^2 - 5x$ _____

38. $4(2x - 3) + 7x$ _____

39. $8 - 2(x + 6) + x$ _____

40. $7(x - 3) + 3(x + 2)$ _____