

Patterns and Relations: Equations – AP Book 7.2: Unit 7

AP Book PR7-10

page 1

1. Circle the following: $7 + 3n = 5 + 2n$, $a + b = 4(b + a)$, $8 - 3n = 5$, $a \times b = b \times a$, $4 + 6n = 5m$

Underline the following:
 $5n - 3$, $7 + 3n$, $4 + 6n - 5m$

2. Sample answer:
Both expressions and equations can include numbers, variables, operations, and brackets.
3. Sample answer:
An equation contains an equal sign, while an expression does not. An expression represents a numerical value, while an equation represents a statement of equality.

4. Sample answer:
 $5n + 3 = 28$
5. b) $-15 + 3(25) = -15 + 75 = 60$
c) $10(7) - (-11) = 70 + 11 = 81$
6. b) $25(4) + 30 = 120$
 $100 + 30 = 120$
 $130 = 120$, false
c) $210 = 90 + 6(20)$
 $210 = 90 + 120$
 $210 = 210$, true

7. b)

$19m, -3m$	18
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c)

$27y, 1x$	-5, 16
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Bonus

$342x$, $-158T$, $-3y$, $2x$, $356y$	140, -52
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8.

VT	V	C	CT
$-37M$	M	-37	108
t	t	1	-23
$1x$	x	1	0

9. a) $40 + 10h$
b) 10
c) 40
d) $40 + 10(5) = \$90$

10. a) $50(h)$
b) 0
c) 50
d) $50(7) = 350$ km
e) number of hours
11. coefficient — hourly rate
constant term — flat fee
variable — number of hours rented

AP Book PR7-11

page 3

1. a) A (2, 6), B (-6, 4), C (-8, -4), D (2, -8)
b) Teacher to check.
2. a) Teacher to check grids.
ii) -2
iii) 0
b) i) (0, 4)
ii) (0, -2)
iii) (0, 0)
c) The x-coordinate is always zero. The y-coordinate is the point where the line crosses the y-axis.

Bonus

- a) -907
b) (0, 437)
3. a)

-5
-2
1
4

- b) Teacher to check.
c) 0, -2
4. a) ii) $y = 27 - 15(0)$
 $y = 27 - 0$
 $y = 27$
y-intercept is 27
iii) $y = -11 - 12(0)$
 $y = -11 - 0$
 $y = -11$
y-intercept is -11
b) i) -5
ii) 27
iii) -11
c) They are the same.

5. a) 13
8
b) -28
-39
c) -43
-25

Bonus

- 982, -1
6. a) 2
-4
 $y = -4x + 2$
b) 15
7
 $y = 7x + 15$
c) -1
-3
 $y = -3x - 1$
7. a) -1
2
 $y = 2x - 1$
b) 2
-2
 $y = -2x + 2$
c) -1
-1
 $y = -x - 1$

8. 3
-2
Teacher to check graph.

AP Book PR7-12

page 6

1. b) $LS = -40 + 3(30)$
 $LS = -40 + 90$
 $LS = 50$
 $RS = 50$
 $LS = RS$, so $x = 30$ is the solution
c) $LS = -18 - 5(0) + 4$
 $LS = -18 - 0 + 4$
 $LS = -14$
 $RS = -1$
 $LS \neq RS$, so $n = 0$ is not the solution
2. b) $LS = -28 + (-5)$
 $LS = -33$
 $RS = -33$
 $LS = RS$, so $b = -5$ is the solution

- c) $LS = 42 - 7$
 $LS = 35$
 $RS = 5(7) + 10$
 $RS = 35 + 10$
 $RS = 45$
 $LS \neq RS$, so $n = 7$ is not the solution

Bonus

- $LS = 7(30) - 300 + 32$
 $LS = 210 - 300 + 32$
 $LS = -58$
 $RS = -690 + 20(30) + 27$
 $RS = -690 + 600 + 27$
 $RS = -63$
 $LS \neq RS$, so $x = 30$ is not the solution
3. a) Marta and Raj
b) Raj
c) Marta
d) Marta and Raj

4. a)

x	$6x + 19$	True?
1	26	no
2	31	no
3	37	no
4	43	yes
5		

$x = 4$

b)

x	$20x - 35$	True?
1	-15	no
2	5	no
3	25	no
4	45	no
5	65	yes

$x = 5$

c)

x	$11x - 40$	True?
0	-40	no
1	-29	no
2	-18	yes
3		
4		

$x = 2$

5. a)

n	$15 + 5n$	Ans.
4	$15 + 5(4)$	35
5	$15 + 5(5)$	40

5 is too high

b)

n	$12n - 7$	Ans.
5	$12(5) - 7$	53
6	$12(6) - 7$	65

5 is too low

c)

n	$8n + 37$	Ans.
5	$8(5) + 37$	77
7	$8(7) + 37$	93

5 is too low

d)

n	$6n - 100$	Ans.
3	$6(3) - 100$	-82
5	$6(5) - 100$	-70

5 is too high

e)

n	$6n + 100$	Ans.
5	$6(5) + 100$	130
6	$6(6) + 100$	136

5 is too low

f)

n	$-80 + 10n$	Ans.
5	$-80 + 10(5)$	-30
8	$-80 + 10(8)$	0

5 is too low

6. Teacher to check guessing and revising.

- a) $x = 5$
 b) $x = 2$
 c) $x = 9$

AP Book PR7-13

page 8

1. a) $x + 4$
 b) $6 + x$
 c) $x + 7$
 2. a) $x + 3 = 7$
 b) $8 = x + 4$

3. a) add 8 apples to the left side
 b) remove 5 apples from the right side
 c) subtract 13 apples from the left side
 d) add 20 apples to the right side

Bonus

remove a bag with n apples from the left side

4. a) $x + 2 = 5$
 b) $11 = 6 + x$
 5. a) Teacher to check.
 b) Teacher to check model.
 $x + 3 - 3 = 8 - 3$
 c) Teacher to check picture.
 $x = 5$
 6. b) $7y$
 c) $2y + 6$
 7. a) $2m = 6$
 b) $8 = 4m$
 8. a) multiply the right side by 5
 b) divide the left side by 14
 9. a) Teacher to check.
 b) Teacher to check model.
 $3m + 3 = 12 + 3$
 c) Teacher to check picture.
 $m = 4$
 d) $LS = 3(4)$ $RS = 12$
 $LS = 12$
 $LS = RS$, so $m = 4$ is the solution

AP Book PR7-14

page 10

1. a) 10
 b) 26
 c) 20

Bonus

- d) 1
 e) 306
 f) 987

2. a) $-$
 b) \times
 c) $+$
 d) $+$
 e) $+$
 f) $+$
 3. a) -9
 b) $\times 15$
 c) $+75$
 d) $+7$
 e) $+9$
 f) $+10$

Bonus

$+25$

4. b) divide by 7
 c) add x
 d) multiply by K
 e) subtract t
 f) divide by n
 5. Teacher to check pictures.
 a) $s = 5$
 b) $x = 2$
 6. b) $64 - 14 = 14 + x - 14$
 $50 = x$
 c) $z - 48 + 48 = 152$
 $+48$
 $z = 200$
 d) $v \times 20 + 20 = 220$
 $+20$
 $v = 11$
 e) $150 + 6 = 6b + 6$
 $25 = b$
 f) $r \div 25 \times 25 = 13 \times 25$
 $r = 325$
 7. b) $LS = 64$
 $RS = 14 + x$
 $RS = 14 + 50$
 $RS = 64$
 $LS = RS$, so $x = 50$ is the solution
 c) $LS = z - 48$
 $LS = 200 - 48$
 $LS = 152$
 $RS = 152$
 $LS = RS$, so $z = 200$ is the solution

- d) $LS = v \times 20$
 $LS = 11 \times 20$
 $LS = 220$
 $RS = 220$
 $LS = RS$, so $v = 11$ is the solution
 e) $LS = 150$
 $RS = 6b$
 $RS = 6(25)$
 $RS = 150$
 $LS = RS$, so $b = 25$ is the solution
 f) $LS = r + 25$
 $LS = 325 + 25$
 $LS = 350$
 $RS = 13$
 $LS = RS$, so $r = 325$ is the solution

8. b) $\frac{14y}{14} = \frac{42}{14}$
 $y = 3$
 c) $\frac{50q}{50} = \frac{450}{50}$
 $q = 9$
 9. b) $\frac{26x}{26} = \frac{13}{26}$
 $x = \frac{13}{26} = \frac{1}{2}$
 c) $\frac{9n}{9} = \frac{7}{9}$
 $x = \frac{7}{9}$

AP Book PR7-15

page 12

1. a) $3b + 2 = 8$
 b) $2b + 4 = 10$
 2. b) $3n + 1 = 7$
 c) $3n + 4 = 7$
 3. Teacher to check.
 4. b) Teacher to check model.
 $2x + 4 - 4 = 10 - 4$
 $2x = 6$
 $\frac{2x}{2} = \frac{6}{2}$
 $x = 3$
 5. b) Start with x . Subtract 35. Divide by 27.
 6. a) $9x + 3$

- b) $q \div 15 - 12$
c) $(w - 23) \div 100$

Bonus

$$49((v \div 14) - 201)$$

7. 11 11 Get back to 11.
15 15 Subtract 4.
5 5 Multiply by 3.
4 4 Add 1.
24 24 Divide by 6.

8. b) $(46 - 10) \div 3$
 $= 36 \div 3$
 $= 12$
Multiply by 3.
Add 10.
9. b) $(m \div 14) - 20$
Add 20. Multiply
by 14.
c) $4r + 9$
Multiply by 9. Divide
by 4.
d) $34z - 85$
Add 85. Divide by 34.

Bonus

$$14y \div 11 + 23 - 8$$

Add 8. Subtract 23.
Multiply by 11. Divide
by 14.

AP Book PR7-16

page 14

1. b) Left side:
 q
 $q \div 5$
 $q \div 5 + 24$
 $q \div 5 + 24 = 43$
Right side:
 $q \div 5 + 24 = 43$
 $q \div 5 + 24 - 24 = 43$
 $- 24$
 $q \div 5 = 19$
 $q \div 5 \times 5 = 19 \times 5$
 $q = 95$
Check:
95, 19, 43, yes

2. b) $30w + 11 - 11 = 221$
 $- 11$
 $30w = 210$
 $30w \div 30 = 210 \div 30$
 $w = 7$

- c) $\frac{t}{6} + 38 - 38 = 47$
 $- 38$
 $\frac{t}{6} = 9$
 $\frac{t}{6} \times 6 = 9 \times 6$
 $t = 54$

3. b) $LS = 30(7) + 11$
 $= 210 + 11$
 $= 221$
 $RS = 221$
 $LS = RS$, so $w = 7$ is
the solution

- c) $LS = \frac{54}{6} + 38$
 $= 9 + 38$
 $= 47$
 $RS = 47$
 $LS = RS$, so $t = 54$ is
the solution

4. b) $\frac{10m}{7} \times 7 = 30 \times 7$
 $10m = 210$
 $10m \div 10 = 210 \div 10$
 $m = 21$

- c) $\frac{7w}{2} \times 2 = 49 \times 2$
 $7w = 98$
 $7w \div 7 = 98 \div 7$
 $w = 14$

5. a) $LS = 72 \div 12$
 $= 6$
 $RS = 6$
 $LS = RS$, so $x = 9$ is
the solution
b) $LS = \frac{10(21)}{7}$
 $= 210 \div 7$
 $= 30$
 $RS = 30$
 $LS = RS$, so $m = 21$
is the solution

- c) $LS = \frac{7(14)}{2}$
 $= 98 \div 2$
 $= 49$
 $RS = 49$
 $LS = RS$, so $w = 14$
is the solution

6. b) $\frac{10n}{14} - 4 + 4 = 1 + 4$
add 4
 $\frac{10n}{14} = 5$
simplify
 $\frac{10n}{14} \times 14 = 5 \times 14$

$$\text{multiply by 14}$$

$$10n = 70$$

simplify
$$10n \div 10 = 70 \div 10$$

divide by 10
$$n = 7$$

- c) $3y \div 2 + 28 - 28$
 $= 40 - 28$
subtract 28
 $3y \div 2 = 12$

$$\text{simplify}$$

$$3y \div 2 \times 2 = 12 \times 2$$

multiply by 2
$$3y = 24$$

simplify
$$3y \div 3 = 24 \div 3$$

divide by 3
$$y = 8$$

- d) $4n \div 5 - 13 + 13$
 $= 7 + 13$
add 13
 $4n \div 5 = 20$
simplify
 $4n \div 5 \times 5 = 20 \times 5$
multiply by 5
 $4n = 100$
simplify
 $4n \div 4 = 100 \div 4$
divide by 4
 $n = 25$
simplify

7. a) $3b$
b) $3b + 2$

- c) $3b + 2 = 17$
d) Teacher to check
picture model.
 $3b + 2 = 17$
 $3b + 2 - 2 = 17 - 2$
 $3b = 15$
 $3b \div 3 = 15 \div 3$
 $b = 5$

- e) There are 5 apples
in each of
Nahid's bags.
8. a) $3r + 20 = 95$
 $3r + 20 - 20$
 $= 95 - 20$
 $3r = 75$
 $3r \div 3 = 75 \div 3$
 $r = 25$
Amo went on
25 rides.

Bonus

$$50 \times 3 + 20 = 170$$

If Amo went on
double the number of
rides (50), he would
have spent \$170.

AP Book PR7-17

page 17

1. b) $g - 23 + 23$
 $= -11 + 23$
 $g = 12$
c) $x + 39 - 39$
 $= -86 - 39$
 $x = -125$
2. b) $LS = 12 - 23 = -11$
 $RS = -11$
 $LS = RS$, so $g = 12$ is
the solution
c) $LS = -125 + 39$
 $= -86$
 $RS = -86$
 $LS = RS$, so $x = -125$
is the solution
3. b) $p + 25 = -55$
 $p + 25 - 25$
 $= -55 - 25$
 $p = -80$
c) $-3 + q + 8 = -62 - 2$
 $5 + q = -64$
 $5 - 5 + q = -64 - 5$
 $q = -69$

Bonus

- $-75 + w + 13 + 12$
 $= -200 - 30 + 40$
 $-50 + w = -190$
 $-50 + 50 + w$
 $= -190 + 50$
 $w = -140$
4. b) $x + 2 + (-2)$
 $= -1 + (-2)$
 $x + \cancel{2} + (\cancel{-2}) = -3$
 $x = -3$
5. Teacher to check pictures.
- a) $m + 3 + (-3)$
 $= -1 + (-3)$
 $m + \cancel{3} + \cancel{-3} = -4$
 $m = -4$
- b) $n + (-2) + 2 = -3 + 2$
 $n + (\cancel{-2}) + \cancel{2} = -1$
 $n = -1$
6. a) Let W be the temperature on Wednesday.
 b) $W - 4$
 c) $W - 4 = -9$
 d) Teacher to check pictures.
 $W + (-4) + 4$
 $= -9 + 4$
 $W + (\cancel{-4}) + \cancel{4} = -5$
 $W = -5$
 e) The coldest temperature on Wednesday was -5 degrees Celsius.
7. a) Let x stand for the year Cleopatra was born.
 b) $x + 25 = -44$
 $x + 25 - 25$
 $= -44 - 25$
 $x = 69$
 c) Cleopatra was born in the year 69 BCE.

Bonus

Let s be Salma's altitude in metres.

$-35 + (-34) + (-25) = s$
 $-35 - 34 - 25 = s$
 $-94 = s$
 Salma is at an altitude of -94 metres.

AP Book PR7-18

page 19

1. Teacher to check.
2. a) $a + 4$
 b) $b - 10$
 c) $7c$
 d) $d + 7$
 e) $f + 8$
 f) $g - 2$
 g) $5h$
 h) $j + 6$
3. b) $k - 5 = 12$
 c) $5m = 30$
 d) $\frac{n}{6} = 4$
 e) $2p + 5 = 35$
 f) $3q - 4 = 17$
 g) $3r = 28 - 4$

Bonus

- $\frac{s}{2} + 2 = 3 + 5$
4. a) $3t + 7 = 31$
 $3t + 7 - 7 = 31 - 7$
 $3t = 24$
 $3t \div 3 = 24 \div 3$
 $t = 8$
 b) $4u - 20 = 44$
 $4u - 20 + 20$
 $= 44 + 20$
 $4u = 64$
 $4u \div 4 = 64 \div 4$
 $u = 16$

Bonus

- c) $4v + 5 = 13 \times 3 - 6$
 $4v + 5 - 5$
 $= 39 - 6 - 5$
 $4v = 28$
 $4v \div 4 = 28 \div 4$
 $v = 7$
- d) $w \div 20 + 7$
 $= 3 \times 6 - 2$
 $w \div 20 + 7 - 7$
 $= 18 - 2 - 7$
 $w \div 20 = 9$
 $w \div 20 \times 20 = 9 \times 20$
 $w = 180$

5. 7 hours – 20 minutes
 – 40 minutes = 6 hours of total driving time
 6 hours \times 80 km per hour
 = 480 km
 Keegan and his uncle travel 480 km.
6. Let S be Ava's son's age.
 $4S - 39 = 5$
 $4S - 39 + 39 = 5 + 39$
 $4S = 44$
 $S = 11$
 Ava's son is 11 years old.

Bonus

Let E be Ed's age.
 Ed's sister: $E - 3$
 Ed's mother: $3E$
 Ed's father: $3E + 4$
 $E + (E - 3) + 3E + (3E + 4)$
 $= 89$
 $8E + 1 = 89$
 $8E = 88$
 $E = 11$
 Ed is 11 years old.
 Ed's mother is 3 times his age, so Ed's mother is $3 \times 11 = 33$ years old.