Linear relations

Answer Key

Multiple Choice
Identify the choice that best completes the statement or answers the question.

__H__ 1. In the equation $P = 7n + 6$, determine the value of P when $n = 9$.

a. 69   b. 22   c. 105   d. 96

$P = 7n + 6$
$= 7(9) + 6$
$= 63 + 6$
$= 69$

__C__ 2. In a table of values for a pattern, $P = 12$ when $n = 3$. Determine the equation that might represent the pattern.

a. $P = 4n + 6$ b. $P = 24 - 3n$ c. $P = 4(6 - n)$ d. $P = 4(n + 6)$

$12 = 4(3) + 6$ $12 = 24 - 3(3)$ $12 = 4(6-3)$ $12 = 4(3+6)$
$12 = 12 + 6$ $\times 24 - 9$ $12 = 4(3)$ $12 \times 4(9)$
                                                    $12 = 12$

__A__ 3. The pattern in this table continues. Determine the expression that relates the number of triangles to the figure number.

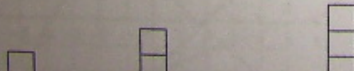| Figure, f	1	2	3	4	5
Number of Triangles, t	2	4	6	8	10

+2 +2 +2 +2

$t = 2f + 0$
$= 2(3)$
$= 6 + 0$

a. $2f$ b. $2 + t$ c. $2t$ d. $2 + f$

__B__ 4. This pattern of unit squares continues. Which equation below relates the number of squares, n, to the figure number, f?

Hint:

B

4. This pattern of unit squares continues. Which equation below relates the number of squares, n, to the figure number, f?
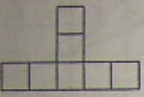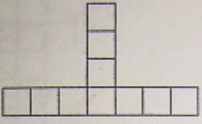
Hint:

Figure 1   Figure 2   Figure 3

i) $n = 3f + 4$
ii) $n = 3f + 1$
iii) $f = 3n + 1$
iv) $f = 4 + 3n$

f	n
1	4)+3
2	7
3	10)+3

$n = 3f + 1$
$= 3(2)$
$= 6 + 1$

a. iii   b. ii   c. iv   d. i

C

5. The cost to print stickers is \$6.55, plus \$0.55 per sticker. $C = 6.55 + 0.55s$
Determine an equation that relates the total cost, C dollars, to the number of stickers, s.
a. $C = 0.55s$ b. $C = 6.55 + s$ c. $C = 6.55 + 0.55s$ d. $C = 7.1s$

B

6. The cost to rent a piece of equipment is \$24, plus \$8.27 per hour.
Calculate the cost of renting the equipment for 6 h.
a. \$1190.88   b. \$73.62   c. \$193.62   d. \$38.27

$y = 24 + 8.27x$
$= 24 + 8.27(6)$
$= 24 + 49.62$
$= 73.62$

A

7. Determine an equation that relates the number of circles, C, to the figure number, n.

A

7. Determine an equation that relates the number of circles, C, to the figure number, n.
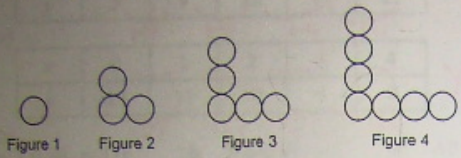

Figure 1   Figure 2   Figure 3   Figure 4

Handwritten annotations:
$= 24 + 49.62$
$= 73.62$

$n \frac{?}{?}$	C
1	1) +2
2	3) +2
3	5) +2
4	7)

$C = 2n - 1$
$= 2(2)$
$= 4 - 1$

a. $C = 2n - 1$ b. $C = n \times n - 1$ c. $C = 2n + 1$ d. $C = n + 1$

A

8. The pattern in this table continues. Determine an equation that relates the term value to the term number.

Term Number, s	1	2	3	4	5
Term Value, w	6	10	14	18	22

+4   +4   +4   +4

$w = 4s + 2$
$4(2)$
$8 + 2$

a. $w = 4s + 2$ b. $w = 6s$ c. $w = 3s + 2$ d. $w = 2s + 4$

B

9. A pattern can be represented by the equation $H = 6n - 1$. *Use your equation skills.* ☺
Which equations could represent the same pattern?
i) $H = 6(n - 1) + 5$
ii) $H = 5(n + 1) + n$
iii) $H = 7n - (n + 1)$
iv) $H = 5n - (1 - n)$

Handwritten work:
$H = 6(n-1) + 5$
$= 6n - 6 + 5$
$= 6n - 1$ ✳

$H = 5(n+1) + n$
$= 5n + 5 + n$
$= 6n + 5$

$H = 7n - (n+1)$
$= 7n - n - 1$
$= 6n - 1$ ✳

$H = 5n - (1 - n)$
$= 5n - 1 + n$
$= 6n - 1$ ✳

a. i, ii, and iii   b. i, iii, and iv   c. i, ii, and iv   d. All of these

Figure 1   Figure 2   Figure 3   Figure 4 $\frac{5}{4}|\frac{3}{7})^{+2}$ $=\cancel{9}-1$

A

a. $C = 2n - 1$ b. $C = n \times n - 1$ c. $C = 2n + 1$ d. $C = n + 1$

8. The pattern in this table continues. Determine an equation that relates the term value to the term number.

Term Number, s	1	2	3	4	5
Term Value, w	6	10	14	18	22

+4 +4 +4 +4

$w = 4s + 2$
$4(2)$
$8 + 2$

B

a. $w = 4s + 2$ b. $w = 6s$ c. $w = 3s + 2$ d. $w = 2s + 4$

9. A pattern can be represented by the equation $H = 6n - 1$. Use your equation skills. ☺
Which equations could represent the same pattern?

i) $H = 6(n - 1) + 5$ $H = 6(n-1) + 5$
ii) $H = 5(n + 1) + n$ $= 6n - 6 + 5$
iii) $H = 7n - (n + 1)$ $= 6n - 1$ ✱
iv) $H = 5n - (1 - n)$

$H = 5(n+1) + n$
$= 5n + 5 + n$
$= 6n + 5$

$H = 7n - (n+1)$
$= 7n - n - 1$
$= 6n - 1$ ✱

$H = 5n - (1 - n)$
$= 5n - 1 + n$
$= 6n - 1$ ✱

a. i, ii, and iii   b. i, iii, and iv   c. i, ii, and iv   d. All of these
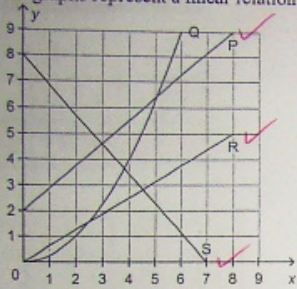
C

10. This pattern of unit squares continues.
Which equation below relates the perimeter, P, to the figure number, n?

Figure 1   Figure 2   Figure 3

n	P
1	8)+2
2	10)+2
3	12)+2

a) i) $P = 6n + 2$
b) ii) $P = 2n + 4$
c) iii) $P = 2n + 6$
d) iv) $P = 2n + 8$
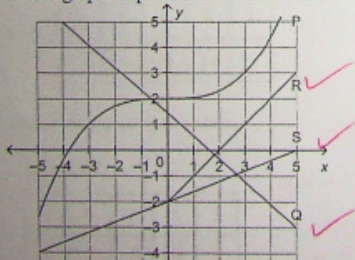
$P = 2n + 6$
$= 2(2)$
$= 4 + 6$

_B_ 11. Which graphs represent a linear relation?

a. P only   b. P, R, and S   c. P and S   d. P and R

_B_ 12. Which graphs represent a linear relation?

13. Which tables of values represent a linear relation?

i)

x	1	2	3	4	5
y	4	7	12	19	28

NO!

+3 +5

ii)

x	0	1	2	3	4
y	0	5	10	15	20

Yes!

+5 +5 +5 +5

iii)

x	1	2	3	4	5
y	5	9	13	17	21

Yes!

+4 +4 +4 +4

iv)

x	0	1	2	3	4
y	12	11	10	9	8

Yes!

-1 -1 -1 -1

a. ii, iii, and iv   b. ii and iii   c. All of these   d. i and iv

14. Which graph represents the equation $y = 2x + 3$?

$$y = \frac{2}{1}x + 3$$
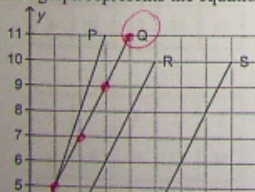
slope $= 2 \frac{rise}{run}$

y-intercept
"where the line
hits the y-axis.

15. Complete the table of values.

$y = 9 - 5x$

x	2	4	6	8
y	−1	−11	−21	−31

$x = 2$
$y = 9 - 5x$
$9 - 5(2)$
$9 - 10$
-1

$x = 4$
$y = 9 - 5x$
$= 9 - 5(4)$
$= 9 - 20$
$= -11$

$x = 6$
$y = 9 - 5x$
$= 9 - 5(6)$
$= 9 - 30$
$= -21$

$x = 8$
$y = 9 - 5x$
$= 9 - 5(8)$
$= 9 - 40$
$= -31$

a.

x	2	4	6	8
y	4	−1	−6	−11

c.

x	2	4	6	8
y	4	8	12	16

b.

x	2	4	6	8
y	8	16	24	32

d.

x	2	4	6	8
y	−1	−11	−21	−31

16. Complete the table of values.

$y = -x + 6$

x	0	1	2	3
y	6	5	4	3

a.

x	0	1	2	3
y	-6	-7	-8	-9

b.

x	0	1	2	3
y	5	4	3	2

$x = 0$
$y = -x + 6$
$= -(0) + 6$
$= 0 + 6$
$= 6$

(c.)

$x = 1$
$y = -x + 6$
$= -(1) + 6$
$= -1 + 6$
$= 5$

$x = 2$
$y = -x + 6$
$= -(2) + 6$
$= -2 + 6$
$= 4$

$x = 3$
$y = -x + 6$
$= -(3) + 6$
$= -3 + 6$
$= 3$

c.

x	0	1	2	3
y	6	5	4	3

d.

x	0	1	2	3
y	0	-6	-12	-18

17. This table of values represents a linear relation. Complete the table.

Look for the pattern.

x	1	3	5	7
y	9	17	25	33

17. This table of values represents a linear relation. Complete the table.

x	1	3	5	7
y	9	17	25	33

+8 +8 +8

Look for the pattern.

a.

x	1	3	5	7
y	9	17	25	33

b.

x	1	3	5	7
y	9	17	21	25

c.

x	1	3	5	7
y	9	17	19	21

d.

x	1	3	5	7
y	9	17	45	63

18. Which table of values represents the equation $y = 11 - 4x$?

a.

x	-2	-1	0	1	2
y	5	6	7	8	9

b.

x	-2	-1	0	1	2
y	19	15	11	7	3

c.

x	-2	-1	0	1	2
y	3	7	11	15	19

d.

x	-2	-1	0	1	2
y	-14	-7	0	7	14

$x = -2$
$y = 11 - 4x$
$= 11 - 4(-2)$
$= 11 + 8$
$= 19$

$x = -1$
$y = 11 - 4x$
$= 11 - 4(-1)$
$= 11 + 4$
$= 15$

$x = 0$
$y = 11 - 4x$
$= 11 - 4(0)$
$= 11 - 0$
$= 11$

$x = 1$
$y = 11 - 4x$
$= 11 - 4(1)$
$= 11 - 4$
$= 7$

19. Sean cycles at an average speed of 5 m/s. He travels a distance, d metres, in t seconds. Write an equation that relates d and t.

   a. $d = \dfrac{t}{5}$ b. $d = t + 5$ c. $d = 5t$ d. $t = 5d$

20. Which points lie on the graph represented by the equation $y = 14 - 5x$?
P(1, 9), Q(2, 18), R(2, 4), S(0, 9)

   a. P and Q   b. Q and R   c. R and S   d. P and R

21. Which line is the graph of $y = 4$?
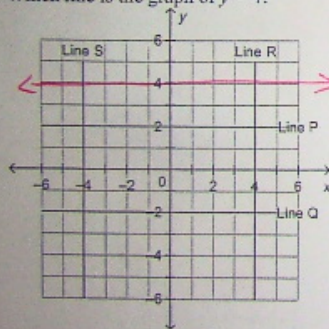
   a. Line S   b. Line P   c. Line Q   d. Line R

Handwritten work:

Seconds | metres (d)
1 | 5)+5
2 | 10)+5
3 | 15)+5

$d = 5t + 0$
$= 5(2)$
$= 10 + 0$

P(1, 9)
$y = 14 - 5x$
$9 = 14 - 5(1)$
$9 = 14 - 5$
$9 = 9$ ✓

Q(2, 18)
$y = 14 - 5x$
$18 = 14 - 5(2)$
$18 = 14 - 10$
$18 \neq 4$
no

R(2, 4)
$y = 14 - 5x$
$4 = 14 - 5(2)$
$4 = 14 - 10$
$4 = 4$ ✓ Yes

S(0, 9)
$y = 14 - 5x$
$9 = 14 - 5(0)$
$9 = 14 - 0$
$9 \neq 14$
no

Draw the line

_D_ 22. Which line is the graph of $x + 5 = 0$?

$x + 5 = 0$ $^{-5}$ $^{-5}$

$x = -5$

22.5 Graph

$y = 5x - 2$

↑ hits the y-axis

$\frac{5}{1}$ rise run
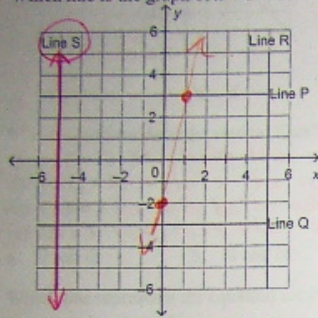
a. Line R   b. Line Q   c. Line P   d. Line S

_A_ 23. For the equation $4x - 2y = 8$, make a table of values for $x = -2, 0,$ and 2.

a.

x	-2	0	2
y	-8	-4	0

$4(-2) - 2y = 8$
$-8 - 2y = 8$
$-2y = 16$
$\frac{-2y}{-2} = \frac{16}{-2}$
$y = -8$

c.

x	-2	0	2
y	8	4	1

b.

x	-2	0	2
y	-8	0	1

d.

x	-2	0	2
y	0	-4	8

x	y
-2	-8
0	-4
2	

$4x - 2y = 8$
$4(0) - 2y = 8$
$-2y = 8$
$\frac{-2y}{-2} = \frac{8}{-2}$
$y = -4$

y	-8	-4	0

$y = -8$

y	8	4	1

-2 -8
-4
0
2

-2 -2
$y = -4$

b.

x	-2	0	2
y	-8	0	1

d.

x	-2	0	2
y	0	-4	8

C

24. Describe the graph of the equation $x + 7 = 0$.
    a. A vertical line that intersects the x-axis at 7.
    b. A horizontal line that intersects the y-axis at -7.
    c. A vertical line that intersects the x-axis at -7.
    d. A horizontal line that intersects the y-axis at 7.
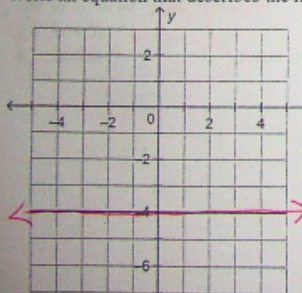
-7 -7
$x + 7 = 0$
$x = -7$

vertical

-7

A

25. Write an equation that describes the line.

$y = -4$

a. $y = -4$ b. $x = 4$

c. $y = 4$ d. $x = -4$

26. Which equation describes a horizontal line? A horizontal line hits the y-axis...

i) $x + 9 = 2$

ii) $y + x = 9$

iii) $y - x = 0$

iv) $y + 2 = 9$

$x + 9^{-9} = 2^{-9}$

$x = -7$

No, hits the x-axis

$y + x = 9$

hits both the x and y axes

$y - x = 0$

Hits both axes

$y + 2^{-2} = 9^{-2}$
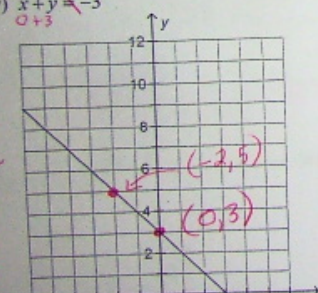
$y = 7$

Yes, hits the y-axis at 7

a. iv   b. ii   c. i   d. iii

---

27. Which equation describes the graph? Use your equation skills

i) $x + y = 3$

ii) $x - y = 3$

iii) $y - x = 3$

iv) $x + y = -3$

$x + y = 3$

$-2 + 5 = 3$

$3 = 3$

ii) $y - x = 3$

$5 - (-2) = 3$

$5 + 2 = 3$

$7 \neq 3$

(i) $x^{-x} + y = 3^{-x}$

$y = -x + 3$

slope $= \frac{-1}{1}$

(ii) $x^{-3} - y = 3^{-3}$

$x - 3 = y$

(iii) $y^{+x} - x = 3^{+x}$

$y = x + 3$

slope $= \frac{1}{1}$

iv) $x^{-x} + y = -3^{-x}$

$y = -x - 3$

... the line and

(-2, 5)

(0, 3)

a. (i)   b. ii   *Choose another point*
c. iii   d. iv

D 28. Which equations describe vertical lines? *Vertical lines hit the x-axis.*

(i) $x + 5 = 12$ *yes, hits the x-axis only*

ii) $y - 12 = 5$ *no, hits the y-axis*

iii) $x + y = 5$ *no, hits both axes*

(iv) $12x = 5$ *yes, hits the x-axis only*

a. i and iii   b. ii and iii   c. ii and iv   (d.) i and iv

A 29. Which line represents the equation $x + y = 4$?
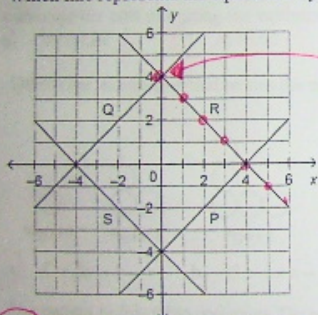
$$\overset{-x}{x} + y = \overset{-x}{4}$$

$$y = -x \boxed{+4}$$

$$Slope = -\frac{1}{1}$$

$$\frac{down\ 1}{over\ 1}$$

a. (Line R)   b. Line S   c. Line P   d. Line Q

B
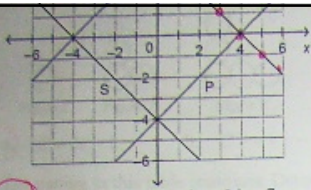
$Slope = -\frac{1}{1}$

$\frac{down\,1}{over\,1}$

a. Line R b. Line S c. Line P d. Line Q

$\mathcal{B}$

30. Which equations describe oblique lines? Oblique lines hit both the
    i) $5x + 9 = 14$ only x-axis x and y axes, so both the x
    ii) $5x + 9y = 14$ both axes and y must be represented.
    iii) $9y + 5 = 14$ only y-axis
    iv) $5x = 9y$ both axes.
    a. iii and iv b. ii and iv c. i and iii d. i and iv

v = -5x + 8

y = $\frac{4}{5}$x - 3

Slope: $\frac{-5}{1}$

y-int: 8

Slope: $\frac{4}{5}$

y-int: -3

y = 3x

x = 5

Slope: $\frac{3}{1}$

y-int: 0

Slope: undefined

y-int: none

y = -4x

Slope: $\frac{-4}{1}$

y-int: 0

Slope: Undefined

y-int: none

Equation: x = -4

Slope: $\frac{4}{2} = \frac{2}{1}$

y-int: -4

Equation: y = 2x - 4

Slope: 0

y-int: -3

Equation: y = -3

Slope: $-\frac{3}{2}$

y-int: 3

Equation: y = $-\frac{3}{2}$x + 3
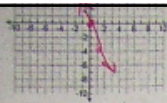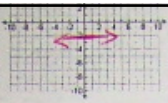
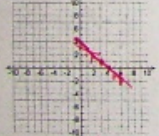| x	y
3	1
4	0
5	-1
6	-2

Slope: undefined
y-int: none

Slope: $-4/1$
y-int: 0
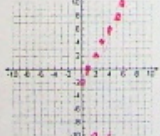
Slope: 0
y-int: x -2

Slope: $-3/2$
y-int: 3
Equation: $y = -\frac{3}{2}x + 3$

x	y
3	-1
4	0
5	-1
6	-2

Slope: $-1/4$
y-int: 4
Equation: $y = -1x + 4$

c	h
5	8
6	10
7	12
8	14

$+2$

Slope: $2/1$
y-int: -2
Equation: $y = 2x - 2$