

Test #1: Linear Systems

MPM2D1

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K/U 20 / 20

A/H 14 / 14

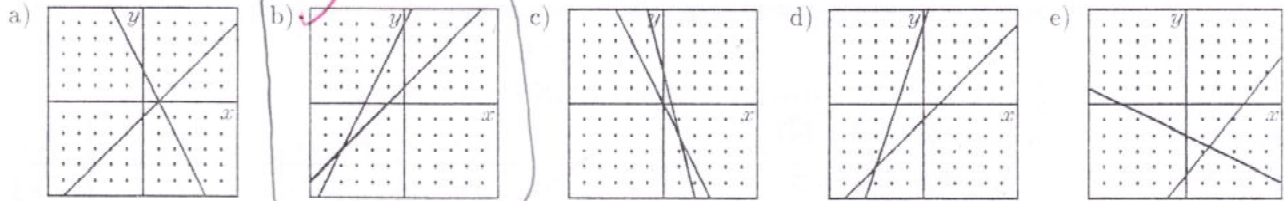
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C 4 / Level

Knowledge and Understanding [21]

Part A – Multiple Choice. Circle your answer.

1. Which graph illustrates the solution to $2x - y = -5$ and $x - y = -1$?



2. Which single equation is equivalent to the two equations shown?

$$2x - y = 1$$

$$2x + 3y = 35$$

a) $2x + 3(2x - 1) = 35$

b) $(y - 1) + 3y = 35$

c) $(3y + 35) - y = 1$

d) $2x + 3(2x + 1) = 35$

e) $4y = -34$

3. Which of the following best describes the lines $y = -2x - 5$ and $y = \frac{1}{2}x + 5$?

a) parallel

b) perpendicular

c) intersecting

d) coincident

e) transversal

4. Consider the following system of equations:

$$y = 2x + 2$$

$$\frac{3}{2}y - 3x = 3$$

The graph of these equations consists of two lines that:

a) intersect at two points.

b) intersect at exactly one point.

c) do not intersect.

d) are not in the same plane.

e) intersect in an infinite number of points.

5. Which pair of equations has no solution?

a) $5x - 3y = 8$

b) $-3x + y = 15$

c) $6x - 2y = 5$

d) $16x = 3y + 1$

$-5x = 12 - 3y$

$4x + y = -2$

$\frac{y}{6} = \frac{3x - 4}{2}$

$\frac{1}{8}x = 3y + \frac{5}{8}$

e) $3(2x + 4y + 3) = 6y + 3(x + 4y - 3)$

$3y - 8x = 4(2x + \frac{y}{3} + 2)$

6. The following system of equations intersects at one point. What is the x -coordinate of this point?

$$y = \frac{1}{2}x - 1$$

$$3x - 2y = 1$$

a) -1

b) $-\frac{1}{2}$

c) $\frac{1}{3}$

d) 1

e) $\frac{3}{2}$

7. Solve the following system of linear equations for y :

$$4x + y = -11$$

$$x + 2y = 6$$

a) -5

b) -4

c) 1

d) 4

e) 5

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Part B – Full solutions. Show all your steps.

9. Solve the following linear systems:

a) by graphing and **check** the solution.

$$2x + 3y = -12$$

$$2x - y = -4$$

$$2x + 3y = -12$$

$$3y = -2x - 12$$

$$y = -\frac{2}{3}x - 4$$

[4]

$$2x - y = -4$$

$$-y = -2x - 4$$

$$y = 2x + 4$$

b) by substitution

$$3f = g - 4 \quad (1)$$

$$2g = f + 3 \quad (2)$$

$$3f = g - 4$$

$$g = 3f + 4 \quad (3)$$

[3]

$$2g = f + 3$$

$$g = \frac{1}{2}f + 1.5 \quad (4)$$

c) by elimination

$$3a + 2b = 16 \quad (1)$$

$$2a + 3b = 14 \quad (2)$$

[3]

$$(3a + 2b = 16)(2)$$

$$6a + 4b = 32 \quad (3)$$

$$(2a + 3b = 14)(3)$$

$$6a + 9b = 42 \quad (4)$$

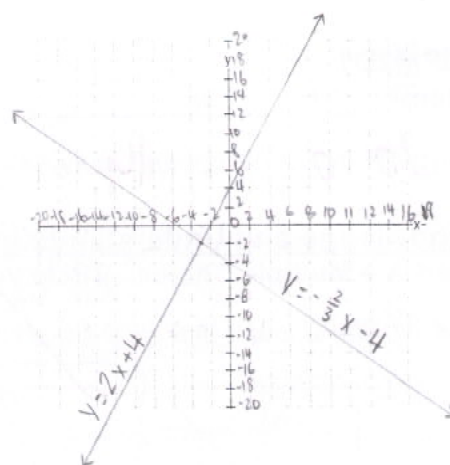
\therefore POI
is $(-3, -2)$

LS	RS
$2x + 3y$	-12
$2(-3) + 3(-2)$	-12
$-6 - 6$	-12
-12	-12

$$\therefore LS = RS$$

LS	RS
$2x - y$	-4
$2(-3) - (-2)$	-4
$-6 + 2$	-4
-4	-4

$$\therefore LS = RS$$



sub (3) into (4)

$$3f + 4 = \frac{1}{2}f + 1.5$$

$$2.5f = -2.5$$

$$f = -1$$

sub $f = -1$ into (1)

$$3f = g - 4$$

$$3(-1) = g - 4$$

$$-3 = g - 4$$

$$g = 1$$

\therefore POI
is $(-1, 1)$

LS	RS
$3f$	$g - 4$
$3(-1)$	$(1) - 4$
-3	-3

$$\therefore LS = RS$$

LS	RS
$2g$	$f + 3$
$2(1)$	$(-1) + 3$
2	2

$$\therefore LS = RS$$

$$\begin{array}{r} 6a + 4b = 32 \\ -6a + 9b = 42 \\ \hline -5b = -10 \end{array}$$

$$b = 2$$

sub $b = 2$ into (1)

$$3a + 2b = 16$$

$$3a + 2(2) = 16$$

$$3a + 4 = 16$$

$$3a = 12$$

$$a = 4$$

\therefore POI
is $(4, 2)$

LS	RS
$3a + 2b$	16
$3(4) + 2(2)$	16
$12 + 4$	16
16	16

$$\therefore LS = RS$$

LS	RS
$2a + 3b$	14
$2(4) + 3(2)$	14
$8 + 6$	14
14	14

$$\therefore LS = RS$$

d) by any method

$$[3] \quad \frac{4a}{3} - \frac{b}{4} = 9 \quad (1)$$

$$\frac{5a}{6} + b = 1 \quad (2)$$

$$16a - 3b = 108 \quad (3)$$

$$5a + 6b = 6 \quad (4)$$

$$(16a - 3b = 108)(6)$$

$$96a - 18b = 648 \quad (5)$$

$$(5a + 6b = 6)(3)$$

$$15a + 18b = 18 \quad (6)$$

$$\begin{array}{r} 96a - 18b = 648 \\ + 15a + 18b = 18 \\ \hline 111a = 666 \\ a = 6 \end{array}$$

sub $a = 6$ into (4)

$$5a + 6b = 6$$

$$5(6) + 6b = 6$$

$$30 + 6b = 6$$

$$6b = -24$$

$$b = -4$$

\therefore POI
is $(6, -4)$

LS	RS
$\frac{4a}{3} - \frac{b}{4}$	9
$\frac{4(6)}{3} - \frac{(-4)}{4}$	9
$8 + 1$	9
9	9

$$\therefore LS = RS$$

LS	RS
$\frac{5a}{6} + b$	1
$\frac{5(6)}{6} + (-4)$	1
$5 - 4$	1
1	1

$$\therefore LS = RS$$

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Application [14]

10. Write an opening statement and equations only. Do Not Solve.

a) Eight years ago Mr. Jordan was twice as old as Lance. The sum of their present ages is 55. How old is Lance.

[3]

let "n" rep Lance's age 8 years ago
let "2n" Mr Jordan's age 8 years ago

$$55 - 8 - 8 = n + 2n$$

b) The sum of two numbers is 255. When the smaller is subtracted from the larger, the result is 39.

Find the numbers. let "n" rep the larger number

[3]

let "n-39" rep the smaller number

$$255 = n + (n - 39)$$

11. Provide full solution. A chemistry teacher needs to make 10 L of 42% sulfuric acid solution. The acid solution available are 30% sulfuric acid and 50% sulfuric acid. How many liters of each solution must be mixed to make the 42% solution?

[4]

let "n" rep Litres of 30%

$$10 - n = 10 - (4)$$

let "10-n" rep Litres of 50%

$$= 6$$

$$0.3n + 0.5(10 - n) = 0.42(10)$$

$$0.3n + 5 - 0.5n = 4.2$$

$$-0.2n = -0.8$$

$$n = 4$$

∴ The chem teacher
need 4L of 30% sulf acid
and 6L of 50% sulf acid

12. Provide full solution.

Nick invested \$5000, part at 6% per annum and the remainder at 3% per annum. After one year, the total interest from these investments was \$240. How much did he invest at each rate?

let "n" rep amount invested at 6%

$$5000 - n$$

let "5000-n" rep amount invested at 3%

$$= 5000 - (3000)$$

$$= 2000$$

[4]

$$0.06n + 0.03(5000 - n) = 240$$

$$0.06n + 150 - 0.03n = 240$$


$$0.03n = 90$$

$$n = 3000$$

∴ he invested \$3000
at 6% and \$2000 at
3%

Thinking/Inquiry/Problem Solving [13]

13. If $(0, 0)$ and $(1, 1)$ are both solutions to a system of two linear equations, does the system have any other solutions? Explain.

yes because if it has 2 solution to 2 linear equations
 [2] it will look like  they are coincident lines
 some other solutions are $(3, 3)$ $(4, 4)$
 $(2185, 2185)$

14. For what values of the coefficients a and b is $(2, -1)$ the solution to the following linear system?

$ax + by = -7$ ①
 $2ax - 3by = 1$ ②
 [4] $ax + by = -7$ $2ax - 3by = 1$
 $2x - 1y = -7$ ③ $4x + 3y = 1$
 $(2x - 1y = -7)(4)$ $(4x + 3y = 1)(2)$
 $8x - 4y = -28$ ⑤ $8x + 6y = 2$
 $\begin{array}{r} 8x - 4y = -28 \\ -8x + 6y = 2 \\ \hline -10y = -30 \\ y = 3 \end{array}$
 \therefore the value of the coefficients is $x = 2$ and $y = 3$

15. State the number of solutions of the following systems:

[3] a) $3x + 5y = 4$

b) $2x - 5 = 4y$

c) $x = 7$

$x = 0$

$6x - 12y = 15$

$y = 7$

one

None

one

16. Provide full solution.

The tens digit of a two-digit number is 6 more than the ones digit. The sum of the number, and the number formed by reversing the digits is 88. Find the number.

[4] xy let x rep the tens digit
 let y rep the one digit
 $x + 6 = y$
 $x = y - 6$
 $xy + yx = 88$
 $(y - 6)y + y(y - 6) = 88$
 $y = 7$
 $x = 7 - 6$
 $x = 1$
 \therefore the number is 17