Math 3 Midterm (Fall 2016)
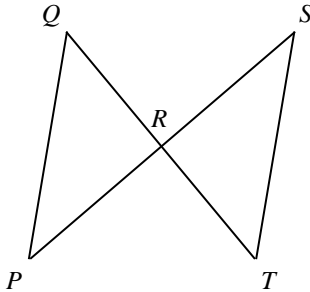
Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Supply the missing reasons to complete the proof.
Given: $\angle Q \cong \angle T$ and $\overline{QR} \cong \overline{TR}$
Prove: $\overline{PR} \cong \overline{SR}$

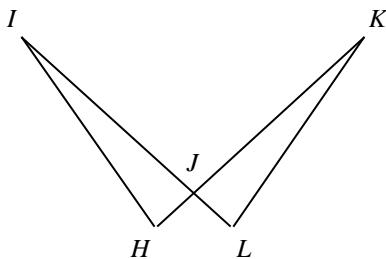| Statement	Reasons
1. $\angle Q \cong \angle T$ and $\overline{QR} \cong \overline{TR}$	1. Given
2. $\angle PRQ \cong \angle SRT$	2. Vertical angles are congruent.
3. $\triangle PRQ \cong \triangle SRT$	3. ___?___
4. $\overline{PR} \cong \overline{SR}$	4. ___?___

a. ASA; Substitution
b. SAS; CPCTC
c. AAS; CPCTC
d. ASA; CPCTC

____ 2. If $\triangle MNO \cong \triangle PQR$, which of the following can you NOT conclude as being true?
a. $\overline{MN} \cong \overline{PR}$ b. $\angle M \cong \angle P$ c. $\overline{NO} \cong \overline{QR}$ d. $\angle N \cong \angle Q$

____ 3. Based on the given information, what can you conclude, and why?
Given: $\angle H \cong \angle L$, $\overline{HJ} \cong \overline{JL}$

a. $\triangle HIJ \cong \triangle LKJ$ by ASA
b. $\triangle HIJ \cong \triangle JLK$ by SAS
c. $\triangle HIJ \cong \triangle JLK$ by ASA
d. $\triangle HIJ \cong \triangle LKJ$ by SAS

____ 4. Given the system of constraints, name all vertices. Then find the maximum value of the given objective function.

$$\begin{cases} x \geq 0 \\ y \geq 0 \\ 6x - 2y \leq 12 \\ 4y \leq 4x + 8 \end{cases}$$

Maximum for $C = 4x - 3y$

a. (0, 2), (2, 0), (4, 6); maximum value of –6
b. (0, 2), (2, 0), (6, 4); maximum value of 12
c. (0, 2), (2, 0), (4, 2); maximum value of 10
d. (0, 2), (2, 0), (4, 6); maximum value of 8

____ 5. Your computer supply store sells two types of inkjet printers. The first, type A, costs $137 and you make a $50 profit on each one. The second, type B, costs $100 and you make a $40 profit on each one. You can order no more than 100 printers this month, and you need to make at least $4400 profit on them. If you must order at least one of each type of printer, how many of each type of printer should you order if you want to minimize your cost?

a. 40 of type A
   60 of type B

b. 30 of type A
   70 of type B

c. 60 of type A
   40 of type B

d. 70 of type A
   30 of type B

____ 6. The table shows the height of a plant as it grows.
a. Model the data with an equation.
b. Based on your model, predict the height of the plant at 12 months.

Time (months)	Plant Height (cm)
3	9
5	15
7	21
9	27

a. $y - 3 = \dfrac{3}{2}(x - 9)$; 39 cm

c. $y - 9 = \dfrac{3}{2}(x - 3)$; 18 cm

b. $y - 9 = 3(x - 3)$; 36 cm

d. The relationship cannot be modeled.

Tell whether the lines for each pair of equations are *parallel*, *perpendicular*, or *neither*.

____ 7. $7x - 4y = 4$
$x - 4y = 3$
a. perpendicular   b. parallel   c. neither

____ 8. $y = -\dfrac{1}{2}x - 11$
$16x - 8y = -8$

a. neither   b. perpendicular   c. parallel

Use a graphing calculator to find the equation of the line of best fit for the data. Find the value of the correlation coefficient _r_.

____ 9.

Average Speed (mi/h)	Time (hours)
8.5	2.5
7.5	3.75
6.5	4.5
6.0	5.0
5.5	5.5
5.0	6.25
4.0	6.75
3.5	8.75

a. $y = 11.83x - 1.11$; $r = -0.9760964904$
b. $y = -1.11x + 11.83$; $r = -0.9760964904$
c. $y = 11.83x - 1.11$; $r = 0.9527643586$
d. $y = -1.11x + 11.83$; $r = 0.9527643586$

____ 10. Find the perimeter of the figure. Simplify the answer.
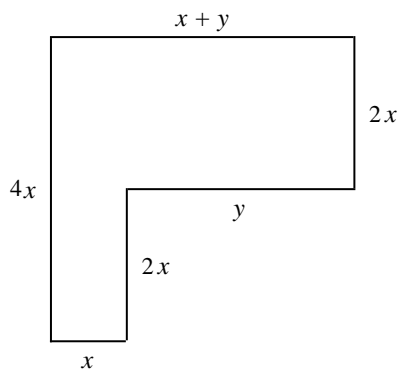
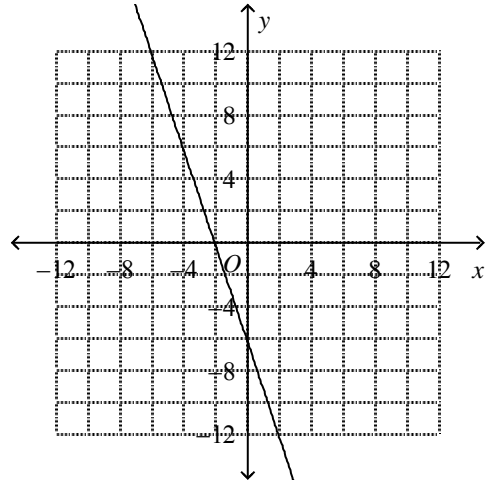a. $9x + 2y$ b. $10x + y$ c. $10x + 2y$ d. $9x + 3y$
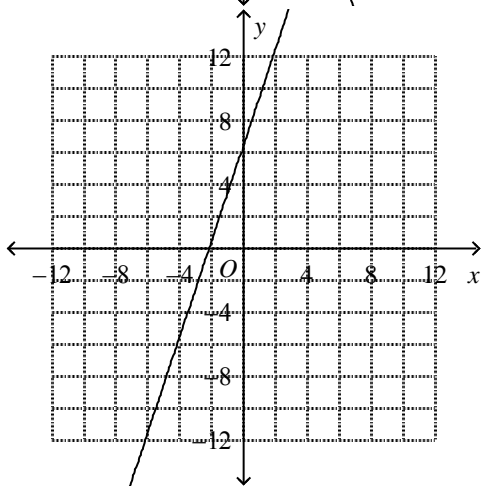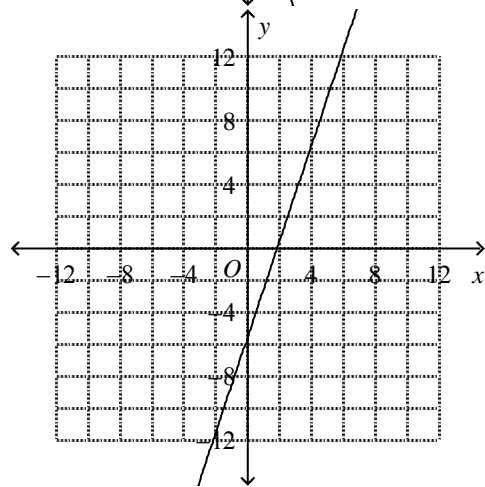
____ 11. Graph the equation $-3x - y = 6$.

a.
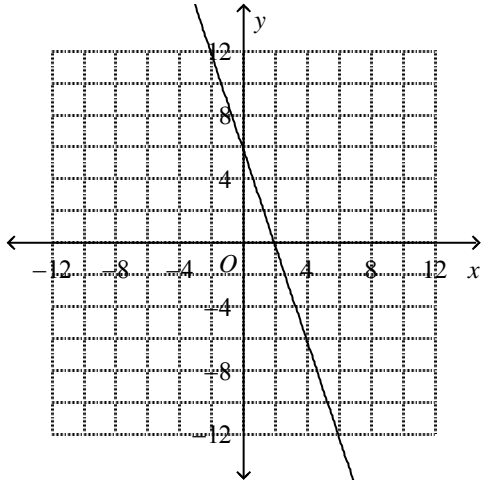
c.

b.

d.

Find the slope of the line.

_____ 12. $3x + 5y = -15$

a. $-\dfrac{5}{3}$ b. $\dfrac{5}{3}$ c. $-\dfrac{3}{5}$ d. $\dfrac{3}{5}$

Find an equation for the line:

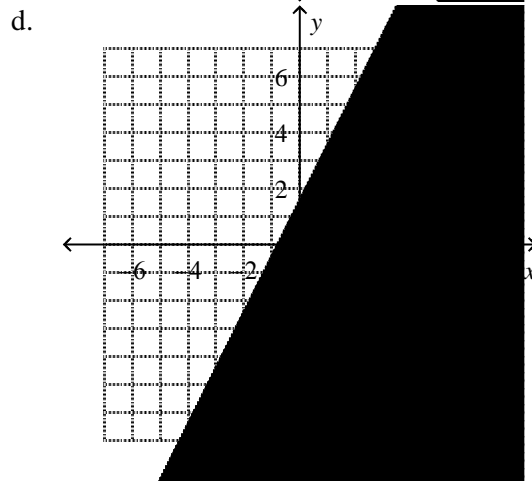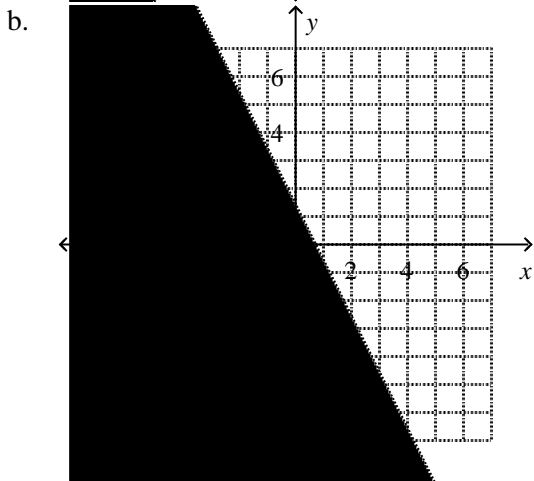_____ 13. through $(-4, 6)$ and parallel to $y = -3x + 4$.
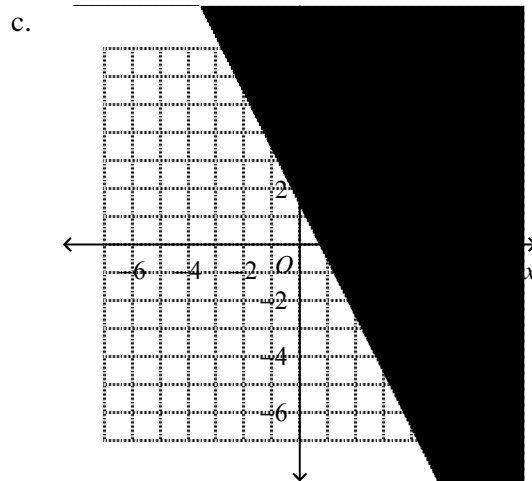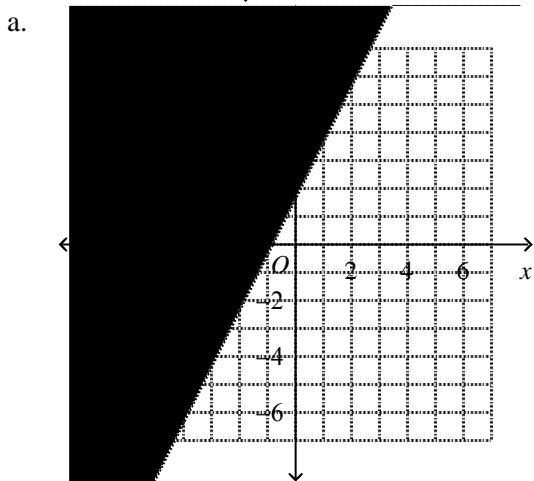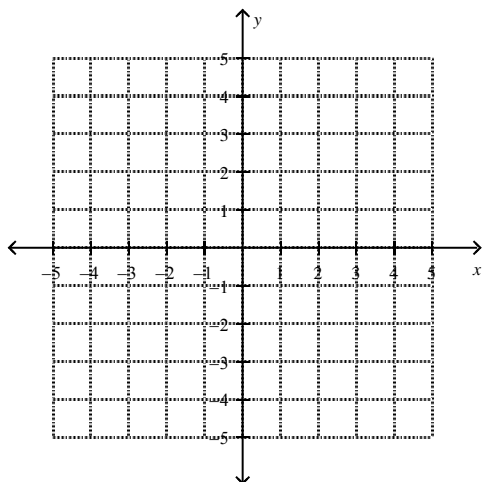
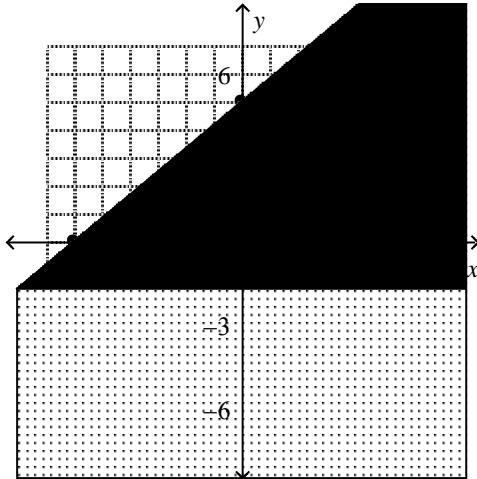a. $y = -3x - 6$ b. $y = 3x + 18$ c. $y = \dfrac{1}{3}x + \dfrac{22}{3}$ d. $y = -\dfrac{1}{3}x + \dfrac{14}{3}$

Graph the inequality.

_____ 14. $4x - 2y < -3$

a.

c.

b.

d.

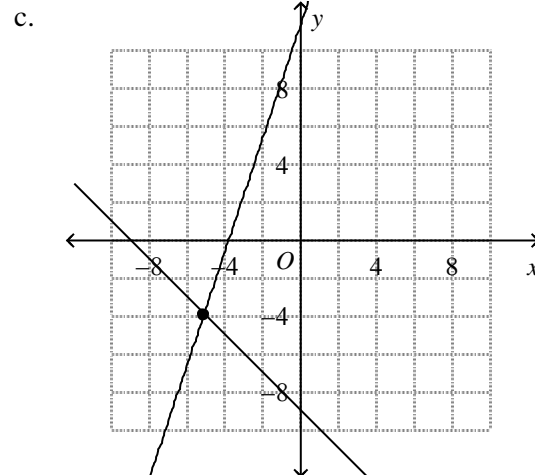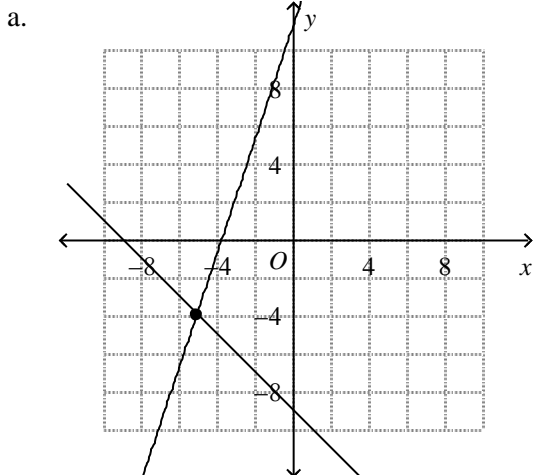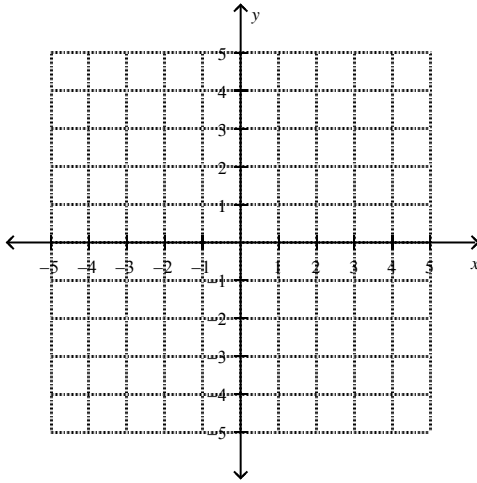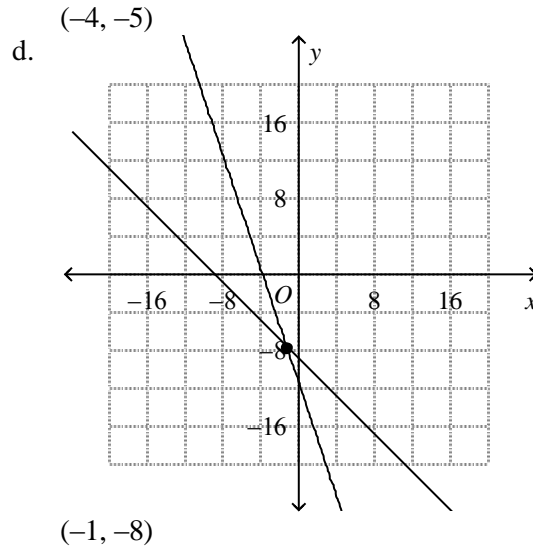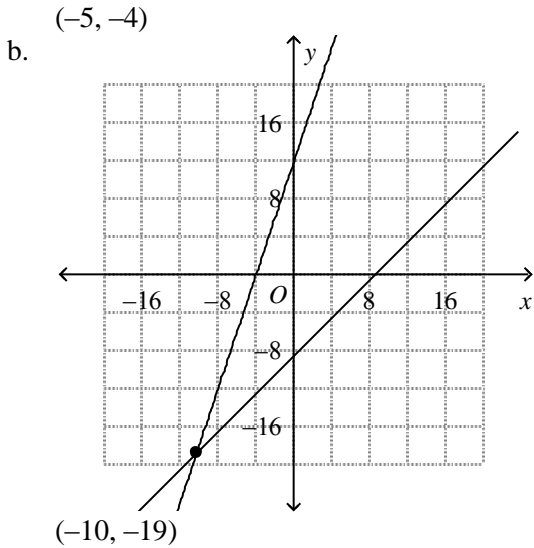_____   15.   Write an inequality for the graph.

a. $-6x + 5y \geq -30$

b. $-6x + 5y \leq -30$

c. $5x - 6y \leq -30$

d. $5x - 6y \geq -30$

Solve the system by graphing.

_____ 16. $\begin{cases} y = -x - 9 \\ 3x - y = -11 \end{cases}$

a.

c.

b. (−5, −4)

(−10, −19)

d. (−4, −5)

(−1, −8)

_____ 17. A rental car agency charges a flat fee of $32.00 plus $3.00 per day to rent a certain car. Another agency charges a fee of $30.50 plus $3.25 per day to rent the same car.
   a. Write a system of equations to represent the cost c for renting a car at each agency for d days.
   b. Using a graphing calculator, find the number of days for which the costs are the same. Round your answer to the nearest whole day.

a.
   a. $\begin{cases} c = 3.00d + 32.00 \\ c = 3.25d + 30.50 \end{cases}$
   b. 11

b.
   a. $\begin{cases} c = 3.00d + 30.50 \\ c = 3.25d + 32.00 \end{cases}$
   b. 6

c.
   a. $\begin{cases} c = 3.00d + 32.00 \\ c = 3.25d + 30.50 \end{cases}$
   b. 6

d.
   a. $\begin{cases} c = 3.00d + 30.50 \\ c = 3.25d + 32.00 \end{cases}$
   b. 11

Solve the system by the method of substitution.

_____ 18. $\begin{cases} 5x - y = 5 \\ 5x - 3y = 15 \end{cases}$
   a. (0, −5)   b. (−5, 0)   c. (5, 1)   d. (1, 5)

_____ 19. A group of 52 people attended a ball game. There were three times as many children as adults in the group. Set up a system of equations that represents the numbers of adults and children who attended the game and solve the system to find the number of children who were in the group.
   a. $\begin{cases} a + c = 52 \\ a = c + 3 \end{cases}$; 39 adults; 25 children
   c. $\begin{cases} a + c = 52 \\ c = a + 3 \end{cases}$; 25 adults; 39 children
   b. $\begin{cases} a + c = 52 \\ a = 3c \end{cases}$; 39 adults, 13 children
   d. $\begin{cases} a + c = 52 \\ c = 3a \end{cases}$; 13 adults, 39 children

_____ 20. The length of a rectangle is 7.8 cm more than 4 times the width. If the perimeter of the rectangle is 94.6 cm, what are its dimensions?

a. length = 7.9 cm; width = 39.4 cm   c. length = 39.4 cm; width = 15.7 cm
b. length = 23.8 cm; width = 15.7 cm   d. length = 39.4 cm; width = 7.9 cm
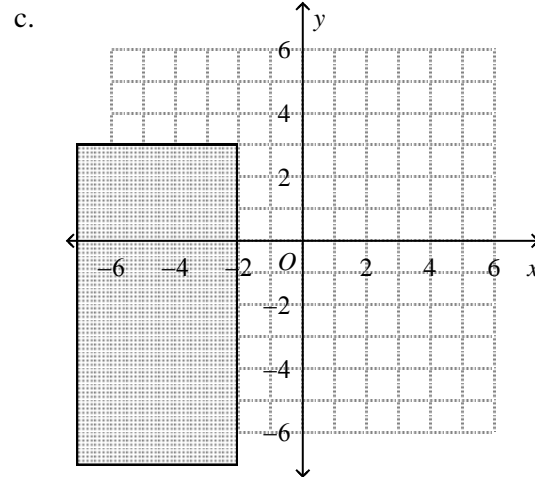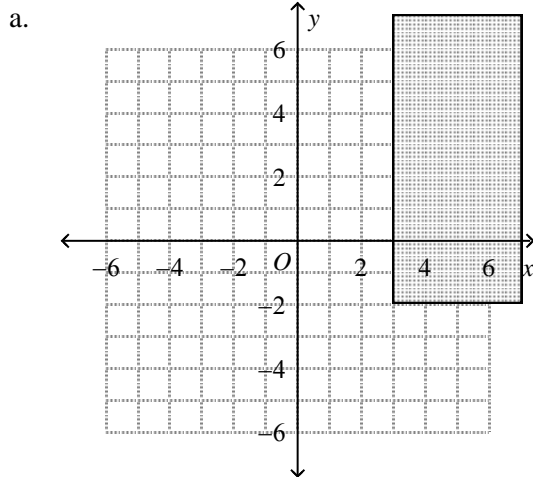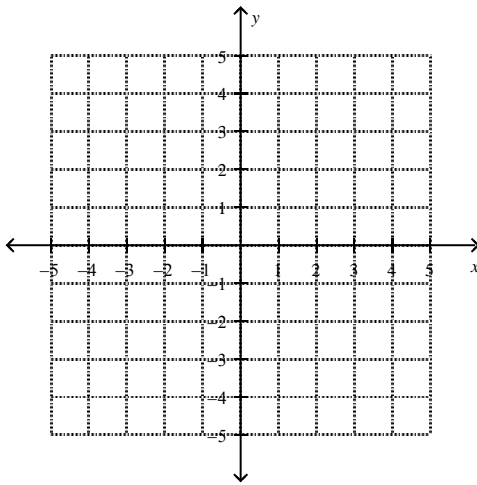
Use the elimination method to solve the system.

____ 21.
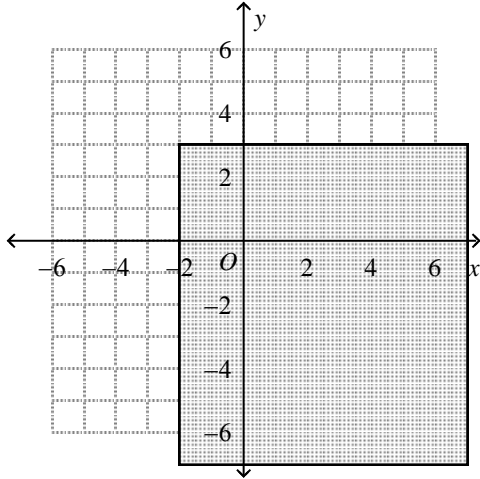$$\begin{cases} -4x + 4y = -8 \\ x - 4y = -7 \end{cases}$$
a. (3, 5)   b. (5, 3)   c. (–3, –5)   d. (–5, –3)
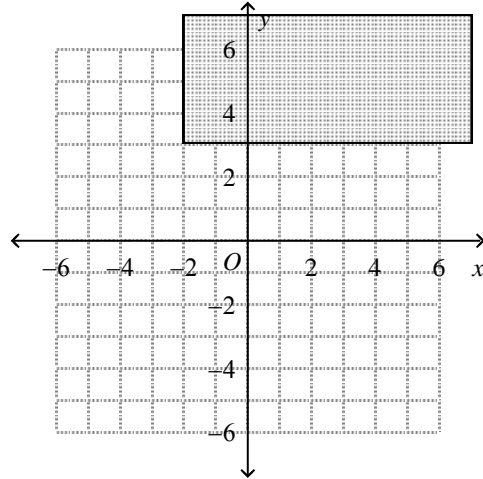
Solve the system of inequalities by graphing.

____ 22.
$$\begin{cases} x \geq -2 \\ y > 3 \end{cases}$$

a.

c.

b.

d.

_____ 23. Your club is baking vanilla and chocolate cakes for a bake sale. They need at most 25 cakes. You cannot have more than 10 chocolate cakes. Write and graph a system of inequalities to model this system.

a. Let x = the number of vanilla cakes.
   Let y = the number of chocolate cakes.

$$\begin{cases} x \geq 0 \\ y \geq 0 \\ x + y < 25 \\ y < 10 \end{cases}$$
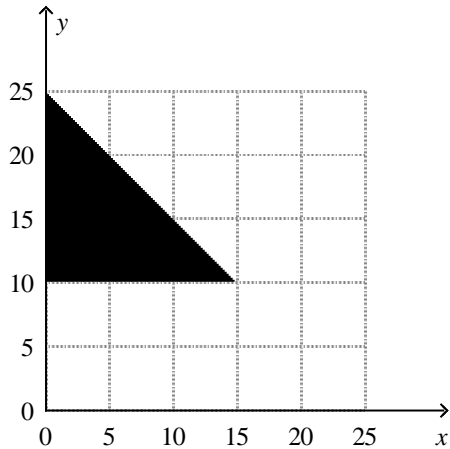
c. Let x = the number of vanilla cakes.
   Let y = the number of chocolate cakes.

$$\begin{cases} x \geq 0 \\ y \geq 0 \\ x + y \geq 25 \\ y \leq 10 \end{cases}$$
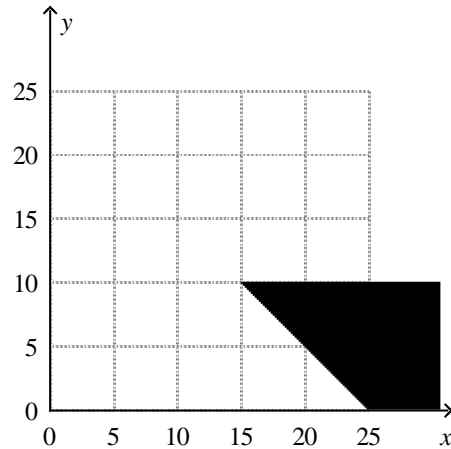
b. Let x = the number of vanilla cakes.
   Let y = the number of chocolate cakes.

$$\begin{cases} x \geq 0 \\ y \geq 0 \\ x + y \leq 25 \\ y \leq 10 \end{cases}$$

d. Let x = the number of vanilla cakes.
   Let y = the number of chocolate cakes.

$$\begin{cases} x \geq 0 \\ y \geq 0 \\ x + y \geq 25 \\ y \geq 10 \end{cases}$$
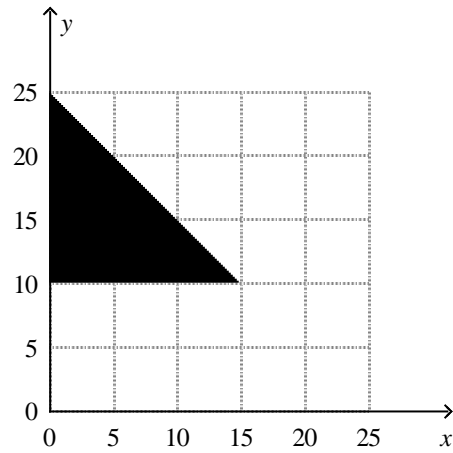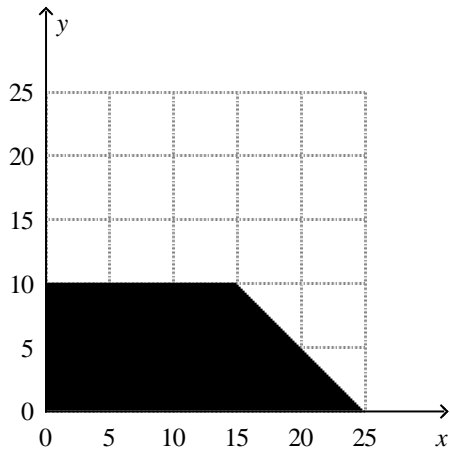
_____ 24. Find the values of x and y that maximize the objective function $P = 3x + 2y$ for the graph. What is the maximum value?
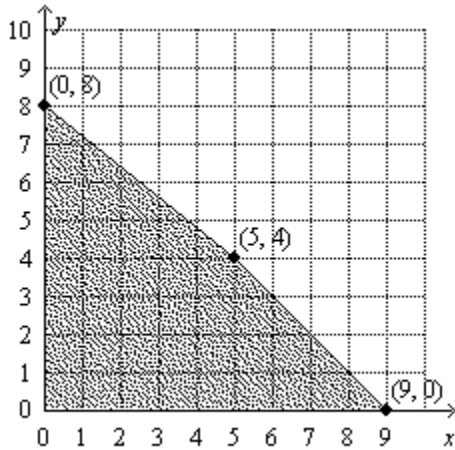
a. maximum value at (5, 4); 32
b. maximum value at (0, 8); 16

c. maximum value at (9, 0); 27
d. maximum value at (0, 0); 0

_____ 25. Identify the vertex and the y-intercept of the graph of the function $y = -3(x + 2)^2 + 5$.

a. vertex: (–2, 5);

c. vertex: (2, 5);

y-intercept: –7
b. vertex: (2, –5);
   y-intercept: –12

y-intercept: –7
d. vertex: (–2, –5);
   y-intercept: 9

_____ 26. Write $y = 2x^2 + 12x + 14$ in vertex form.
   a. $y = 2(x + 12)^2 + 14$
   b. $y = 6(x + 9)^2 - 4$
   c. $y = (x + 3)^2 + 14$
   d. $y = 2(x + 3)^2 - 4$

Factor the expression.

_____ 27. $-15x^2 - 21x$
   a. $x(-15x - 21)$
   b. $-15x(x + 7)$
   c. $-3x(5x + 7)$
   d. $5x(x - 3 + 7)$

_____ 28. $x^2 + 14x + 48$
   a. $(x + 6)(x - 8)$
   b. $(x + 8)(x - 6)$
   c. $(x - 8)(x - 6)$
   d. $(x + 6)(x + 8)$

_____ 29. $3x^2 + 26x + 35$
   a. $(x + 5)(3x + 7)$
   b. $(3x + 7)(x - 5)$
   c. $(3x + 5)(x - 7)$
   d. $(3x + 5)(x + 7)$

_____ 30. $5x^2 - 22x - 15$
   a. $(5x + 3)(x + 5)$
   b. $(x + 3)(5x - 5)$
   c. $(5x + 3)(x - 5)$
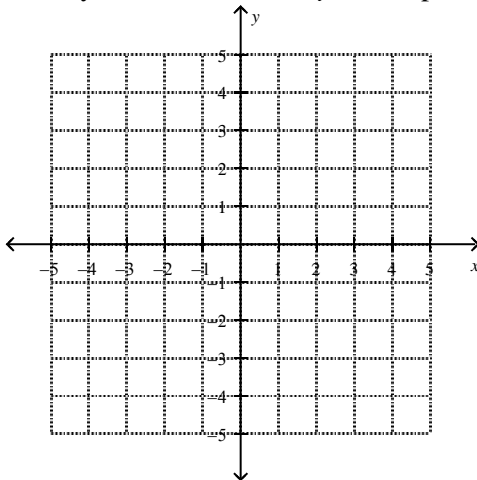   d. $(5x - 5)(x - 3)$

_____ 31. $9x^2 - 16$
   a. $(3x + 4)(-3x - 4)$
   b. $(3x + 4)(3x - 4)$
   c. $(-3x + 4)(3x - 4)$
   d. $(3x - 4)^2$

_____ 32. Solve by factoring.
   $4x^2 + 28x - 32 = 0$
   a. $8, -\dfrac{1}{2}$
   b. $-8, 4$
   c. $-8, 1$
   d. $1, -\dfrac{1}{2}$

Solve the equation by finding square roots.

_____ 33. $108x^2 = 147$
   a. $-\dfrac{49}{36}, \dfrac{49}{36}$
   b. $-\dfrac{7}{6}, \dfrac{7}{6}$
   c. $-\dfrac{6}{7}, \dfrac{6}{7}$
   d. $-\dfrac{36}{49}, \dfrac{36}{49}$

_____ 34. Use a graphing calculator to solve the equation $8x^2 - 5x - 10 = 0$. If necessary, round to the nearest hundredth.
   a. 1.16, –1.16
   b. 1.47, –0.85
   c. 2.95, –1.7
   d. 0.85, –1.47

_____ 35. $-6 - \sqrt{-48}$
   a. $6 + i\sqrt{48}$
   c. $6 - 4i\sqrt{3}$

b. $-6 - 4i\sqrt{3}$　　　　　　　　　　　　　　　　d. $-6 + 4i\sqrt{3}$

Simplify the expression.

____ 36. $(2 - 5i) - (3 + 4i)$
   a. $1 + 9i$　　　　　　　　　　　　　　c. $-1 - 9i$
   b. $5 - i$　　　　　　　　　　　　　　　d. $-10i$

____ 37. $(2 + 5i)(-1 + 5i)$
   a. $-27 + 5i$　　　　　　　　　　　　c. $-2 + 25i$
   b. $23 + 5i$　　　　　　　　　　　　　d. $-2 + 5i$

Solve the equation.

____ 38. $9x^2 + 16 = 0$
   a. $-\frac{4}{3}i, \frac{4}{3}i$　　　　　　　　　　c. $-\frac{3}{4}i, \frac{3}{4}i$
   b. $-\frac{16}{9}i, \frac{16}{9}i$　　　　　　　　d. $-\frac{4}{3}, \frac{4}{3}$

____ 39. Find the missing value to complete the square.
   $x^2 + 2x + \underline{\quad}$
   a. 2　　　　　　b. 1　　　　　　c. 4　　　　　　d. 8

Solve the quadratic equation by completing the square.

____ 40. $x^2 + 10x + 35 = 0$
   a. $-10 \pm \sqrt{15}$　　　　　　　　c. $100 \pm i\sqrt{10}$
   b. $5 \pm i\sqrt{15}$　　　　　　　　　d. $-5 \pm i\sqrt{10}$

Use the Quadratic Formula to solve the equation.

____ 41. $-2x^2 + x + 8 = 0$
   a. $\frac{1}{4} \pm \frac{\sqrt{65}}{4}$　　　　　　　　c. $\frac{1}{2} \pm \frac{\sqrt{65}}{2}$
   b. $4 \pm \frac{\sqrt{130}}{4}$　　　　　　　　d. $\frac{1}{4} \pm \frac{\sqrt{32}}{2}$

____ 42. Zach wrote the formula $w(w - 1)(5w + 4)$ for the volume of a rectangular prism he is designing, with width w, which is always has a positive value greater than 1. Find the product and then classify this polynomial by degree and by number of terms.
   a. $5w^5 - w^4 - 4w^3$; quintic trinomial
   b. $20w^2$; quadratic monomial
   c. $5w^3 - w^2 - 4w$; cubic trinomial
   d. $5w^4 - w^3 - 4w^2$; quartic trinomial

Describe the pattern in the sequence. Find the next three terms.

_____ 43. 13, 15, 17, 19, ...
  a. Add 2; 23, 25, 27.
  b. Multiply by 2; 38, 76, 152.
  c. Add –2; 17, 15, 13.
  d. Add 2; 21, 23, 25.

_____ 44. Write a recursive formula for the sequence 8, 10, 12, 14, 16, ... Then find the next term.
  a. $a_n = a_{n-1} + 2$, where $a_1 = 8$; 18
  b. $a_n = a_{n-1} + 2$, where $a_1 = 18$; 8
  c. $a_n = a_{n-1} - 2$, where $a_1 = 8$; 18
  d. $a_n = a_{n-1} - 2$, where $a_1 = 2$; –2

_____ 45. Is the formula $a_n = -4n(n-1)$ is *explicit* or *recursive*? Find the first five terms of the sequence.
  a. recursive; 1, –4, 16, –64, 256   c. explicit; 1, –4, 16, –64, 256
  b. recursive; 0, –16, –24, –48, –80   d. explicit; 0, –8, –24, –48, –80

Is the sequence arithmetic? If so, identify the common difference.

_____ 46. 13, 20, 27, 34, ...
  a. yes, 7   b. yes, –7   c. yes, 13   d. no

_____ 47. Find the 50th term of the sequence 5, –2, –9, –16, ...
  a. –352   b. –343   c. –338   d. –331

_____ 48. A grocery clerk sets up a display of 12-pack cartons of cola. There are 15 cartons at the base of the triangle and one at the top. How many cartons of cola are needed for the complete display?

  a. 180 cartons   c. 120 cartons
  b. 30 cartons   d. 15 cartons

_____ 49. If $EF = 2x - 12$, $FG = 3x - 15$, and $EG = 23$, find the values of x, EF, and FG. The drawing is not to scale.
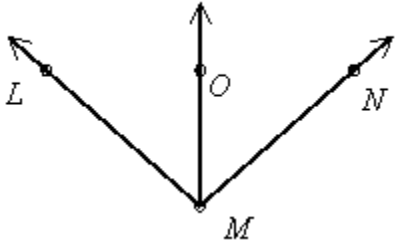
E   F   G

  a. $x = 10$, $EF = 8$, $FG = 15$ c. $x = 10$, $EF = 32$, $FG = 45$
  b. $x = 3$, $EF = -6$, $FG = -6$ d. $x = 3$, $EF = 8$, $FG = 15$

_____ 50. If T is the midpoint of $\overline{SU}$, find the values of x and ST. The diagram is not to scale.

S   T   U

9x   4x + 25
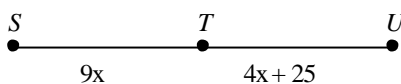
  a. $x = 5$, $ST = 45$ c. $x = 10$, $ST = 60$
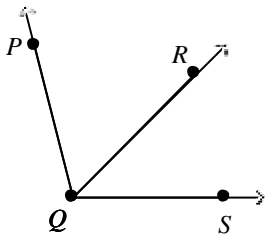 b. $x = 5$, $ST = 60$ d. $x = 10$, $ST = 45$

_____ 51. $\overrightarrow{MO}$ bisects $\angle LMN$, $m\angle LMO = 8x - 23$, and $m\angle NMO = 2x + 37$. Solve for x and find $m\angle LMN$. The diagram is not to scale.

a. $x = 9$, $m\angle LMN = 98$ c. $x = 10$, $m\angle LMN = 114$
b. $x = 9$, $m\angle LMN = 49$ d. $x = 10$, $m\angle LMN = 57$

Fill in each missing reason.

_____ 52. **Given:** $m\angle PQR = x - 5$, $m\angle SQR = x - 11$, and $m\angle PQS = 100$.
Find x.

Drawing not to scale

$m\angle PQR + m\angle SQR = m\angle PQS$	**a.** _____
$x - 5 + x - 11 = 100$	**b.** Substitution Property
$2x - 16 = 100$	**c.** Simplify
$2x = 116$	**d.** _____
$x = 58$	**e.** Division Property of Equality

a. Angle Addition Postulate; Subtraction Property of Equality
b. Protractor Postulate; Addition Property of Equality
c. Angle Addition Postulate; Addition Property of Equality
d. Protractor Postulate; Subtraction Property of Equality

_____ 53. **Given:** $11x - 6y = -1$; $x = 8$

Prove: $\dfrac{89}{6} = y$

$11x - 6y = -1; x = 8$ a. _____

$88 - 6y = -1$ b. _____

$-6y = -89$ c. _____

$y = \dfrac{89}{6}$ d. _____

$\dfrac{89}{6} = y$ e. _____

   a. a. Given
       b. Symmetric Property of Equality
       c. Subtraction Property of Equality
       d. Division Property of Equality
       e. Reflexive Property of Equality
   b. a. Given
       b. Substitution Property
       c. Subtraction Property of Equality
       d. Division Property of Equality
   e. Symmetric Property of Equality

   c. a. Given
       b. Substitution Property
       c. Subtraction Property of Equality
       d. Division Property of Equality
       e. Reflexive Property of Equality
   d. a. Given
       b. Substitution Property
       c. Subtraction Property of Equality
       d. Addition Property of Equality
       e. Symmetric Property of Equality

____ 54. Name the Property of Congruence that justifies the statement:
If $\angle A \cong \angle B$ and $\angle B \cong \angle C$, then $\angle A \cong \angle C$.
   a. Transitive Property   c. Reflexive Property
   b. Symmetric Property   d. none of these

____ 55. Name an angle supplementary to $\angle EOD$.
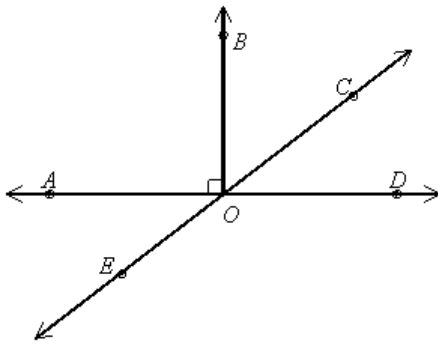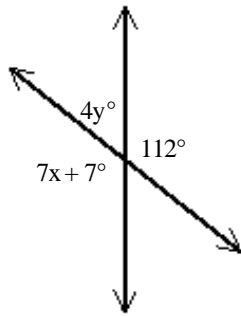

   a. $\angle BOC$ b. $\angle BOE$ c. $\angle DOC$ d. $\angle BOA$

____ 56. $\angle DFG$ and $\angle JKL$ are complementary angles. $m\angle DFG = x + 5$, and $m\angle JKL = x - 9$. Find the measure of
each angle.
   a. $\angle DFG = 47, \angle JKL = 53$ c. $\angle DFG = 52, \angle JKL = 48$
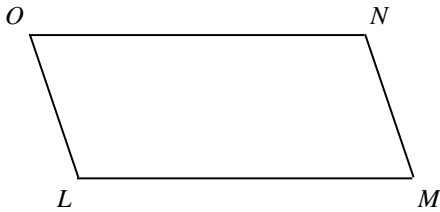   b. $\angle DFG = 47, \angle JKL = 43$ d. $\angle DFG = 52, \angle JKL = 38$

____ 57. Find the values of x and y.

Drawing not to scale

a. $x = 15$, $y = 17$ c. $x = 68$, $y = 112$
b. $x = 112$, $y = 68$ d. $x = 17$, $y = 15$

_____ 58. *LMNO* is a parallelogram. If $NM = x + 15$ and $OL = 3x + 5$ find the value of x and then find *NM* and *OL*.
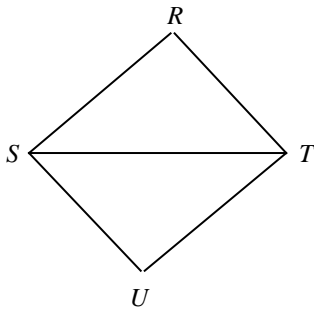

a. $x = 7$, $NM = 20$, $OL = 22$ c. $x = 7$, $NM = 22$, $OL = 22$
b. $x = 5$, $NM = 20$, $OL = 20$ d. $x = 5$, $NM = 22$, $OL = 20$

_____ 59. Justify the last two steps of the proof.
Given: $\overline{RS} \cong \overline{UT}$ and $\overline{RT} \cong \overline{US}$
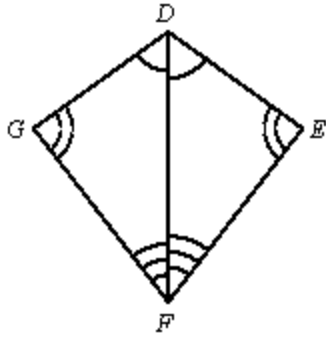Prove: $\triangle RST \cong \triangle UTS$

Proof:
1. $\overline{RS} \cong \overline{UT}$ 1. Given
2. $\overline{RT} \cong \overline{US}$ 2. Given
3. $\overline{ST} \cong \overline{TS}$ 3. __?__
4. $\triangle RST \cong \triangle UTS$ 4. __?__
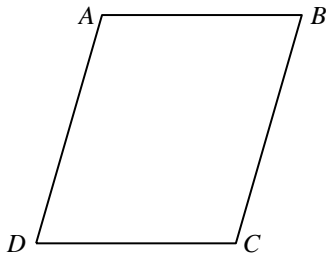
a. Symmetric Property of $\cong$; SSS   c. Reflexive Property of $\cong$; SSS
b. Reflexive Property of $\cong$; SAS   d. Symmetric Property of $\cong$; SAS

_____ 60. From the information in the diagram, can you prove $\triangle FDG \cong \triangle FDB$? Explain.
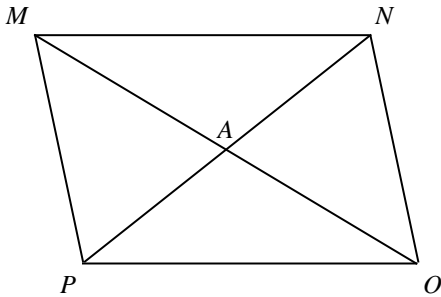
a. yes, by ASA   c. yes, by SAS
b. yes, by AAA   d. no

_____ 61. *ABCD* is a parallelogram. If $m\angle DAB = 115$, then $m\angle BCD = $ __?__. The diagram is not to scale.

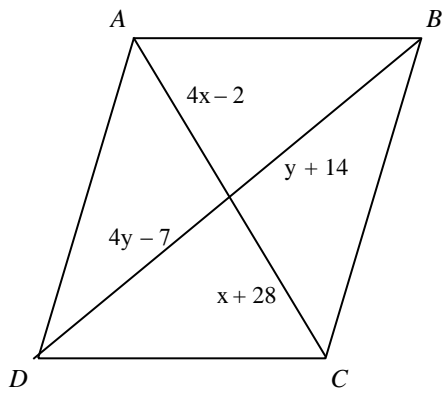a. 125   b. 65   c. 75   d. 115

_____ 62. Find *AM* in the parallelogram if *PN* =9 and *AO* = 4. The diagram is not to scale.

a. 8   b. 4   c. 9   d. 4.5

_____ 63. Find values of *x* and *y* for which *ABCD* must be a parallelogram. The diagram is not to scale.

a. $x = 10, y = 38$ b. $x = 10, y = 21$ c. $x = 10, y = 7$ d. $x = 7, y = 10$

Math 3 Midterm (Fall 2016)
Answer Section

MULTIPLE CHOICE

1. D
2. A
3. A
4. D
5. A
6. B
7. C
8. B
9. B
10. C
11. C
12. C
13. A
14. A
15. D
16. A
17. C
18. A
19. D
20. D
21. B
22. D
23. B
24. C
25. A
26. D
27. C
28. D
29. D
30. C
31. B
32. C
33. B
34. B
35. B
36. C
37. A
38. A
39. B
40. D
41. A

42. C
43. D
44. A
45. D
46. A
47. C
48. C
49. A
50. A
51. C
52. C
53. B
54. A
55. C
56. D
57. A
58. B
59. C
60. A
61. D
62. B
63. C