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Exercises

I. Linear equations and their graphs

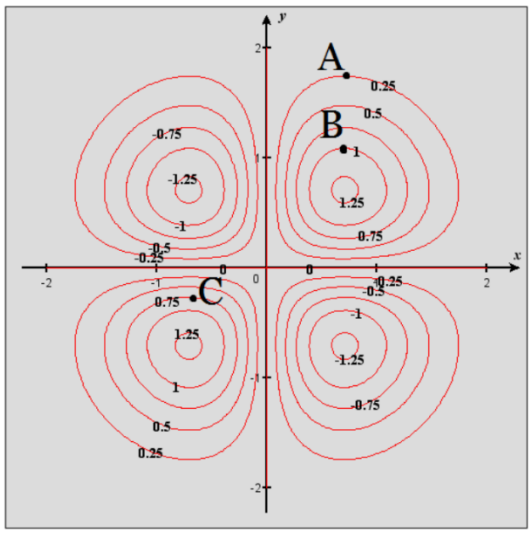
a. Algebra and geometry of slopes

1. There are b boys in the class. This is three more than four times the number of girls. How many girls are in the class?
a. If b is 11, how many girls are in the class?

2. Many counties in Tennessee missed school days in the spring of 2010 due to a massive flood. One solution for how to make up those days was to add time to each school day for a portion of the year. Say that 10 minutes were added to each day. How many extended days would be needed to make up 5 school days, which last 6 hours each?

3. Attorney A charges a fixed fee of $250 for an initial meeting and $150 per hour for all hours worked after that.
a. Write an equation for the amount she charges in slope-intercept form.
b. Attorney B charges $150 for the initial meeting and $175 per hour. Find the charge for 26 hours of work for each attorney.
c. Which is the better deal?
d. At how many hours does hiring Attorney B become a better deal?

b. Level Curves



1. a. If a person were walking straight from point A to point B, would she be walking uphill or downhill?

b. Is the slope steeper at point B or point C?

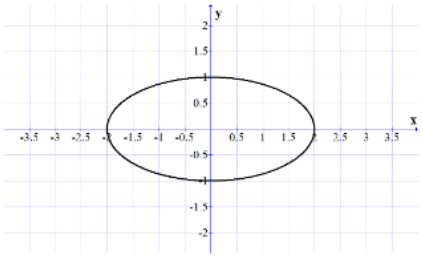
c. Starting at C and moving so that x remains constant and y decreases, will the elevation begin to increase or decrease?

d. Starting at B and moving so that y remains constant and x increases, will the elevation begin to increase or decrease?

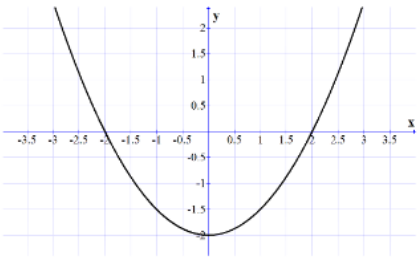
2. Plot a few points and sketch the level curves $f(x,y) = k$ for the specified values of k.
a. $k = 2x - y \rightarrow k = -2, -1, 0, 1, 2$
b. $k = y^2 + 3x \rightarrow k = -9, -1, 0, 1, 9$

3. Multiple Choice: Which of the following graphs is the level curve for $f(x,y) = x^2 + 4y^2$ which passes through $(-2,0)$?

(a)



(d)



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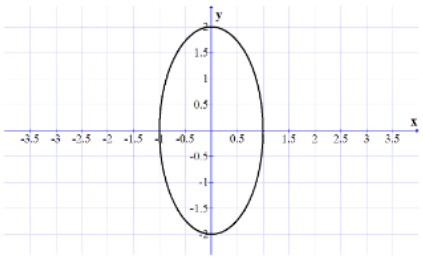
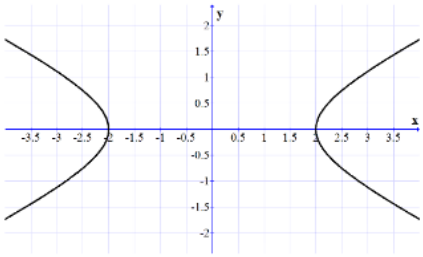


(e)



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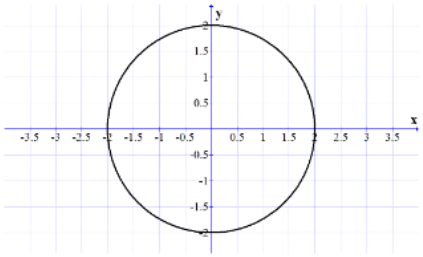
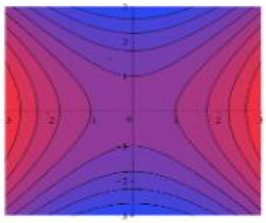


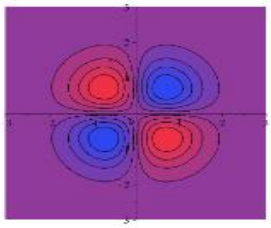
4. (See below)

Matching: Each of the following contour plots were drawn on the window $[-3,3] \times [-3,3]$ in the xy-plane. Points with larger z-values are shaded in blue. Those with smaller z-values are shaded in red. Match each contour map (a-f) to an appropriate graph (I-VI).

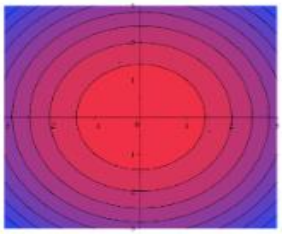
(a)



(b)



(c)



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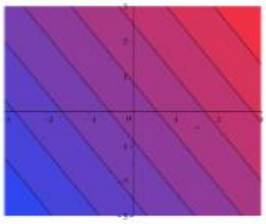

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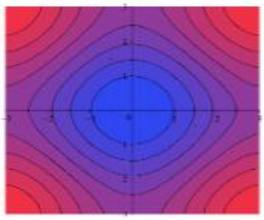
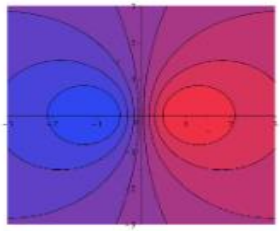


(f)



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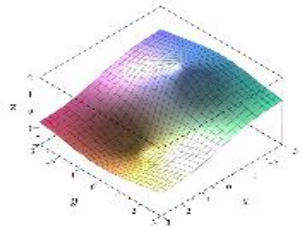
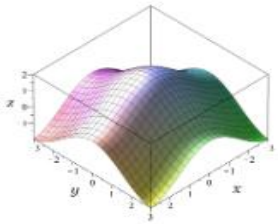
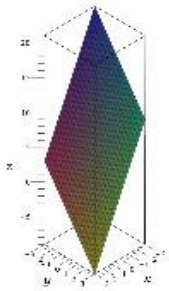
(I)



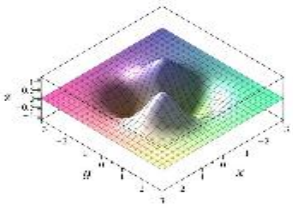
(II)



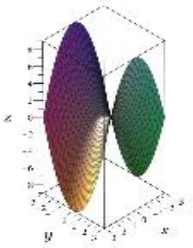
(III)



(IV)



(V)



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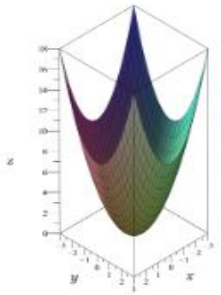

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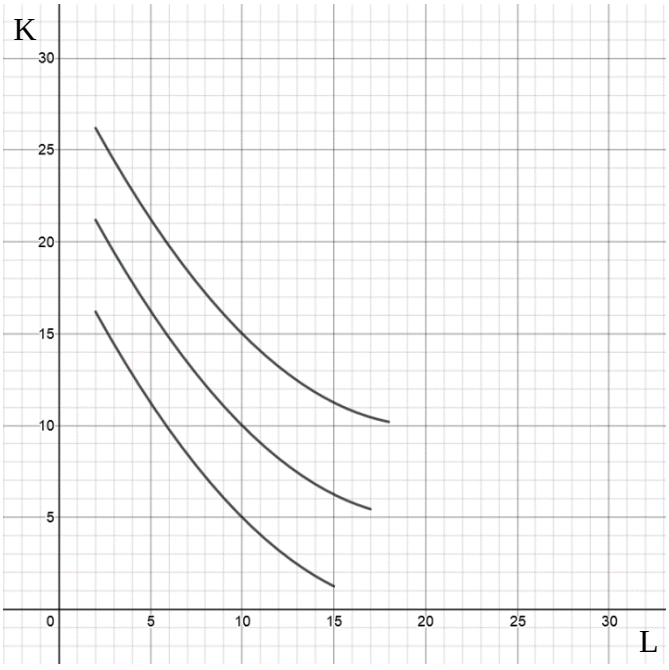
5. On this graph of isoquants, draw a line showing all the combinations of K and L such that $K = 2L$ and a line such that K = 13 regardless of what value L takes. What does it mean to move along these lines? Explain fully.



c. Solving two linear equations

1. One number is 10 more than another. The sum of twice the smaller plus three times the larger is 55. What are the two numbers?

2. Austin has more money than Saul. If Austin gave Saul $20, they would have the same amount. But if Saul gave Austin $22, Austin would then have twice as much as Saul. How much does each one actually have?

3. Claudia invested $30,000; part at 5%, and part at 8%. The total interest on the investment was $2,100. How much did she invest at each rate?

4. The perimeter of Susan's rectangular garden is 60 feet. If the length of the garden is twice the width, what are the dimensions of the garden?

5. The largest of five consecutive even integers is 2 less than twice the smallest. Which of the following is the largest integer?

6. The amount of oil used by a ship traveling at a uniform speed varies jointly with the distance and the square of the speed. If the ship uses 200 barrels of oil in traveling 200 miles at 36 miles per hour, determine how many barrels of oil are used when the ship travels 360 miles at 18 miles per hour.

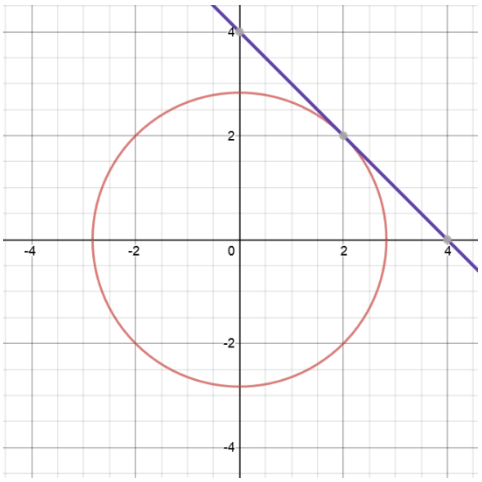
7. Lidia inherited a sum of money. She split it into five equal chunks. She invested three parts of the money in a high interest bank account which added 10% to the value. She placed the rest of her inheritance plus $500 in the stock market but lost 20% on that money. If the two accounts end up with exactly the same amount of money in them, how much did she inherit?

d. Linear Equation with side constraint (rationing)

1. *Susan the gardener wants to optimize her flower mix in order to maximize honeybees. She can buy seeds for two different types of flowers, zinnias and nasturtiums. She estimates that each zinnia will attract 25 bees, while each nasturtium will attract 20 bees. Each plant requires a different amount of fertilizer; one zinnia requires 20 ounces of fertilizer to produce, while one nasturtium requires 12 ounces. Her supply of fertilizer is limited to at most 1800 ounces. She also needs water to grow the flowers, and about 15 flowers of either type can be grown per gallon. She may only use 8 gallons of water on the project. How many seeds of each type should she buy?*

e. Tangency

1. Below is the graph of the circle $x^2 + y^2 = 9$ *and the line* $y = -x + [A]$. *What is* A *equal to?*



2. Below is the graph of the parabola $\frac{1}{2}x^2 + [B]$ *and the line* $y = -x + 3$. *What is* B *equal to?*