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Example 1:
Find the length of a .

Write down known.
Law of Cosines
Substitute.
Simplify.

$$b = 21, c = 32, m\angle A = 40^\circ$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$a^2 = (21)^2 + (32)^2 - 2(21)(32) \cos 40^\circ$$

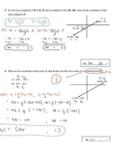
$$a^2 = 441 + 1024 - 1344 \cos 40^\circ$$

$$\sqrt{a^2} = \sqrt{441 + 1024 - 1344 \cos 40^\circ}$$

$$a \approx 20.87$$

Round to the nearest hundredth.

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Multiplication Word Problems Two
Math Worksheet 3

Name: _____

There are 4 marbles in each box. How many marbles are in 8 boxes?

Answer:
4 marbles * 8 boxes = 32 marbles

Kathy has 10 boxes of marbles. Each box holds 8 marbles. How many marbles does Kathy have?

Answer:
10 boxes * 8 marbles = 80 marbles

Each child has 3 marbles. If there are 90 children, how many marbles are there in total?

Answer:
3 marbles * 90 children = 270 marbles

There are 8 cards in each box. How many cards are in 60 boxes?

Answer:
8 cards * 60 boxes = 480 cards

Each card costs \$6.00. How much do 2 cards cost?

Answer:
\$6.00 * 2 cards = \$12.00

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Worksheet #3 (Parallel Lines Cut by a Transversal)

Name: _____ Date: _____ Period: _____

Use the figure at the right to answer problems 1- 8.

Classify each pair of angles as one of the following:

(a) alternate interior angles (b) corresponding angles
(c) alternate exterior angles (d) vertical angles
(e) supplementary angles (f) none

1. _____ $\angle 9$ & $\angle 16$ 5. _____ $\angle 9$ & $\angle 11$
2. _____ $\angle 15$ & $\angle 11$ 6. _____ $\angle 9$ & $\angle 15$
3. _____ $\angle 10$ & $\angle 15$ 7. _____ $\angle 13$ & $\angle 14$
4. _____ $\angle 12$ & $\angle 15$ 8. _____ $\angle 14$ & $\angle 11$

9. $m\angle 2 = 97^\circ$ $m\angle 6 = 83^\circ$
 $m\angle 3 =$ _____ $m\angle 5 =$ _____
 $m\angle 10 =$ _____ $m\angle 7 =$ _____
 $m\angle 9 =$ _____ $m\angle 16 =$ _____

Find the value of x given that $s \parallel t$

10. $m\angle 4 = 77^\circ, m\angle 8 = 4x + 57$

11. $m\angle 3 = 5x + 13, m\angle 5 = 53^\circ$

12. $m\angle 1 = 6x - 5, m\angle 7 = 115^\circ$

It makes for a neater result. The centroid The first two equations are easy to solve together. I strongly suggest that you keep fractions as fractions in these calculations. Our strategy will be: Find the midpoints of all three sides Using the midpoint and corresponding vertex, find the equation of each of the three medians Solve the equations of the medians simultaneously to find the location of the centroid, the one point that solves the equations of all of the medians. Analytic geometry or coordinate geometry is geometry with numbers. The slope of the segment with endpoints $(-2, -3)$ and $(4, 4)$ is calculated here. In analytic geometry, vertices and special points have coordinates $(-x, y)$ in the 2D plane, (x, y, z) in 3D space, and so on. We manipulate these coordinates and equations to change geometric figures, explore their properties and create new forms. These problems usually involve many steps, so I'll try to lay them out that way. You're Reading a Free Preview Pages 5 to 7 are not shown in this preview. Saif A. Finding the midpoints The midpoints of each line segment are found using the midpoint formula, as we did in the last problem. Complex calculations are rich with possibilities for small errors. If you're able to solve this kind of problem, you know a lot about linear equations, slope, distance, midpoint and basic coordinate geometry. Find the equation of a line perpendicular to, and passing through the midpoint of, the segment that has endpoints $(-2, -3)$ and $(4, 4)$. Find the point(s) of intersection of the curves defined by these equations: $\frac{x^2}{4} + \frac{(y-2)^2}{4} = 1$; $\frac{x^2}{9} + \frac{y^2}{4} = 1$ Solution: The equation on the left is a circle of radius $r = 2$ and centered at $(0, 2)$: $\frac{x^2}{4} + \frac{(y-2)^2}{4} = 1$ The other is an ellipse centered at the origin with a major axis (along x) of 3 units and a minor axis (along y) of two units: $\frac{x^2}{9} + \frac{y^2}{4} = 1$ Here's a picture of the two: We can use the circle to solve for x^2 : $x^2 + \frac{(y-2)^2}{4} = 1$ $x^2 = 1 - \frac{(y-2)^2}{4}$ $x = \pm \sqrt{1 - \frac{(y-2)^2}{4}}$ Now substitute that value of x^2 for x^2 in the ellipse equation gives $9 - \frac{(y-2)^2}{4} + \frac{(y-2)^2}{4} = 4$ $9 - \frac{(y-2)^2}{4} = 4$ $5 = \frac{(y-2)^2}{4}$ $(y-2)^2 = 20$ $y-2 = \pm \sqrt{20}$ $y = 2 \pm 2\sqrt{5}$ $y = 2 + 2\sqrt{5}$ or $y = 2 - 2\sqrt{5}$ Now complete the square to solve this equation (find the roots): $9 - \frac{(y-2)^2}{4} = 4$ $5 = \frac{(y-2)^2}{4}$ $(y-2)^2 = 20$ $y-2 = \pm \sqrt{20}$ $y = 2 \pm 2\sqrt{5}$ $y = 2 + 2\sqrt{5}$ or $y = 2 - 2\sqrt{5}$ Now our formula for x , from above, was $x = \pm \sqrt{1 - \frac{(y-2)^2}{4}}$ giving $x = \pm \sqrt{1 - \frac{(2 \pm 2\sqrt{5})^2}{4}}$ or $x = \pm \sqrt{1 - (1 \pm 2\sqrt{5} + 5)}$ or $x = \pm \sqrt{-4 \pm 2\sqrt{5}}$ These are our two intersection points: $(-2.106, 1.524)$ and $(2.106, 1.524)$. It's worth considering just how two closed figures, like ellipses, might intersect. It is most convenient to express them in standard form in preparation for solving for the values of x and y that satisfy all three equations — the centroid. If you're behind a web filter, please make sure that the domains *.kastatic.org and *.kasandbox.org are unblocked. Below are several representative problems that I hope will help you get a good feel for the kinds of things that can be done with analytic geometry. The centroid is the center of area. Here's an analytic geometry problems that will hone your skills with conic sections and call on your best algebra skills. Think of it like this: If the triangle

was made of something like metal with a continuous thickness, the centroid would be its center of balance — the triangle would balance perfectly at this point. Here's a sketch of the two lines. It's helpful to plot the two given points on a graph (a sketch is all that's needed), and draw the segment. For example, the graph of $x^2 + y^2 = 1$ is a circle in the xy plane. Parts like these are made by programmed machines, and that programming is mathematical coordinates and equations that specify every feature of the part, translated from an engineer's mind to his/her computer to the machine. Imagine trying to manufacture the complexly-shaped turbofan blades of the GE turbine engine (left). Finally, we have the slope of our new line and a point through which it passes, so we can find its equation and put it into a pleasing form. These will appear as double roots in your calculations, while lack of intersection will result in no solution. Now let's apply a similar kind of problem solving to a different problem, finding the centroid of a triangle. Solution: Here are the steps we'll take to solve this problem. 2. answered • 10/08/18 Mathematics - Algebra a Specialty / F.I.T. Grad - B.S. w/Honors Find the intersection point of the two given lines: Subtracting will eliminate the x variable Plugging into the line $x+y= 0$: The lines cross at $(-1, 1)$ we want the equation of the line through $(-1,1)$ parallel to the line through $(2,-1)$, $(4,6)$ Slope of that line is $(6-(-1))/(4-2) = 7/2$ Parallel lines have same slope so you want the equation of line through $(-1,1)$ with slope $7/2$ $y - y_1 = m(x - x_1)$ where $(x_1, y_1) = (-1,1)$ To graph plug in a value for x and solve for y to find a point on the graph: There are two points on the line. Often, doing so will help you to recognize when simple numerators or denominators cancel to simplify your work. Each contains complicated curves in each of the three dimensions that must be precisely formed in hard metals that are likely difficult to work with. Thank you very much for your cooperation. Note that some of the intersections are points of tangency. In this section, we will learn some analytic geometry by example. We can rearrange the slope-intercept form of the equation of a line, $y = mx + b$, to $b = y - mx$ and plug in our slope and midpoint (x, y) to find the y -intercept, $b = \frac{1}{2} = \frac{6}{7}(1) = -\frac{5}{14}$ Put it all together to get the equation of our line: $y = -\frac{6}{7}x - \frac{5}{14}$ or $12x + 14y = -5$ In that last step, I just multiplied everything through by 14 to get rid of the fractions. Any opinions expressed on this website are entirely mine, and do not necessarily reflect the views of any of my employers. As usual, the slope of a line is just the change in y (Δy) divided by the change in x (Δx) between two points. asked • 10/08/18 Find and graph the equation of the straight line through the intersection point of the two lines: $x+4y = 3$, $x + y = 0$ and parallel to the straight line passing through the points $(2, -1)$ and $(4, 6)$ 2 Answers By Expert Tutors Andrew M. Here is a picture of the centroid location. If you're seeing this message, it means we're having trouble loading external resources on our website. They can be added to eliminate y and arrive at $x = 1/3$. The resulting midpoints are shown in the graph. In order to continue enjoying our site, we ask that you confirm your identity as a human. When the coordinates of the triangle are as simple as these, it's easy to find midpoints by inspection — midpoints are just the ordered pair: (average of the x -coordinates, average of the y -coordinates). Then re substitution of x into either equation gives $y = 4/3$. Find the equation of the new line Now that we have a point (the midpoint of the original segment) and a slope (what we just calculated above), we have enough information to find the equation of our perpendicular line. Curves are represented by equations. Find the midpoint The midpoint of a segment can be found just by finding the average of the x -coordinates and the average of the y -coordinates. All text and images on this website not specifically attributed to another source were created by me and I reserve all rights as to their use. Solution: The centroid of a triangle is located at the intersection of the three medians. Please feel free to send any questions or comments to jeff.cruzan@verizon.net. The location of the centroid $(1/3, 4/3)$ can be substituted into the third equation and confirmed. Many of the foundational ideas in this section have been covered in other sections on distance, slope, midpoint and conic sections. 4. Recall that the centroid of a triangle is a line segment drawn from one vertex to the midpoint of the opposite side. kactly.com by Dr. Jeff Cruzan is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License. Then we'll need the midpoint of that segment, for which we'll employ the midpoint formula (average the x -coordinates and average the y -coordinates) Next we'll need to calculate the slope of our segment, then the slope of a line perpendicular to it is the negative reciprocal of that. If you think about it, you'll come up with these possibilities: You can see that two ellipses can intersect not at all, once, twice, three or four times. The slope of our segment is $7/6$, so the slope of a line perpendicular to it has the negative reciprocal slope, $m = -6/7$. © 2012, Jeff Cruzan. The Boeing 777 aircraft, ubiquitous in the skies now as a passenger carrier, was the first such plane that was entirely built and tested on computers before a prototype was manufactured. Finding the equations The process for finding equations of each of the three medians are shown in the table below. Photo: General Electric Aviation Analytic geometry is how we translate engineering, architectural, artistic and other ideas into a language that builders, machinists and machines can use to physically create the things of which we dream. Find the centroid of the triangle with vertices at $(0, 4)$, $(4, 2)$ and $(-3, -2)$. The intersection point is $(-1,1)$ The slope is $(6 + 1)/(4 - 2) = 7/2$ $7x + 5 = 2y$ is the required equation. We only need to find two, but it's a good idea to find all three because the arithmetic in these problems can get tricky and that third median will confirm whether our centroid location is correct. There are many paths through calculations like this, but choose wisely to limit the complexity of the calculation.

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