Junior High Math League

Sample Questions by Meet and Topic

Meet 5:

5.1 Solving Systems of Linear Equations
5.2 Operations with Polynomials
5.3 The Pythagorean Theorem
5.4 Surface Area and Volume of 3-D Figures
5.5 Simple Probability and the Counting Principle
5.6 Transformations in the Coordinate Plane

(All sample questions were taken from previous JH Math League meets. Please contact Bill Theisen at btheisen@isd2899.k12.mn.us with any questions regarding the sample questions and answers.)

5.1 Solving Systems of Linear Equations - Questions

1) What is the point of intersection of $2x + 3y = 7$ and $5y = 3x - 1$?

2) Find the two points where $y = |x - 4|$ and $y = \frac{2}{3}x - 2$ intersect. Express the coordinates as improper fractions or integers.

3) What is the area of a parallelogram formed by $y = 1$, $y = x + 3$, $y = 5$, and $y = x - 3$.

4) What is the intersection of $y = 3x + 4$ and $y = x - 2$?

5) If I would like a line with a slope of 1/2 to intersect $y = 2x - 5$, where $x = 2$, what would be the equation of that line in slope-intercept form?

6) The equation for line *A* is $y = -\frac{1}{3}x + 12$. Line *B* is perpendicular to line *A* and has a *y*-intercept of (0, 2). Where do lines *A* and *B* intersect?

5.1 Solving Systems of Linear Equations - Answers

1) What is the point of intersection of *2x + 3y = 7* and *5y = 3x – 1*?

   (2, 1)

2) Find the two points where $y = |x - 4|$ and $y = \frac{2}{3}x - 2$ intersect. Express the coordinates as improper fractions or integers.

   Answers: $\left(\frac{18}{5}, \frac{2}{5}\right)$ $(6, 2)$

3) What is the area of a parallelogram formed by *y = 1*, *y = x + 3*, *y = 5*, and *y = x – 3*.

   24 units^2

4) What is the intersection of *y = 3x + 4* and *y = x – 2*?

   (–3, –5)

5) If I would like a line with a slope of 1/2 to intersect *y = 2x – 5*, where *x = 2*, what would be the equation of that line in slope-intercept form?

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

6) The equation for line *A* is $y = -\frac{1}{3}x + 12$. Line *B* is perpendicular to line *A* and has a *y*-intercept of (0, 2). Where do lines *A* and *B* intersect?

   (3, 11)

5.2 Operations with Polynomials - Questions

1) Simplify:

$(3x^2 + 4x - 7) - 2(x^2 - 2x + 3)$

2) Simplify and write in descending order:

$14 + 3(x^2 - 2) - 4(5 + 3x) - (x^2 + 3)$

3) Write as a trinomial in descending order:

$(2x + 7)(9x - 4)$

4) Simplify:

$\frac{x^2 - 4}{x + 2}$

5) Simplify:

$\frac{x^2 + 2x - 24}{x - 4}$

6) Simplify and write in descending order:

$1 + 2x^2 - 5x(3 - x)$

7) Factor: $x^2 - 18x + 45$

8) One factor of the expression $6x^2 + 7x - 20$ is $(2x + 5)$. What is the other factor?

5.2 Operations with Polynomials - Answers

1) Simplify:

$(3x^2 + 4x - 7) - 2(x^2 - 2x + 3)$

$x^2 + 8x - 13$

2) Simplify and write in descending order:

$14 + 3(x^2 - 2) - 4(5 + 3x) - (x^2 + 3)$

$2x^2 - 12x - 15$

3) Write as a trinomial in descending order:

$(2x + 7)(9x - 4)$

$18x^2 + 55x - 28$

4) Simplify:

$\frac{x^2 - 4}{x + 2}$

$x - 2$

5) Simplify:

$\frac{x^2 + 2x - 24}{x - 4}$

$x + 6$

6) Simplify and write in descending order:

$1 + 2x^2 - 5x(3 - x)$

$7x^2 - 15x + 1$

7) Factor: $x^2 - 18x + 45$

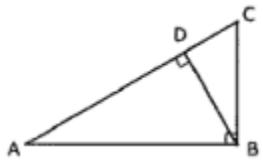
$(x - 15)(x - 3)$

8) One factor of the expression $6x^2 + 7x - 20$ is $(2x + 5)$. What is the other factor?

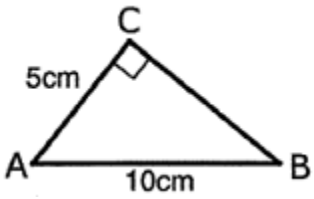
$(3x - 4)$

5.3 The Pythagorean Theorem - Questions

1) In right triangle *ABC*, *BD* is an altitude. If *AC* = 2 in and *BC* = 1 in, what is the length of *BD*?



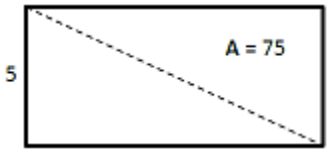
2) What is the exact value of the area of right triangle *ABC*?



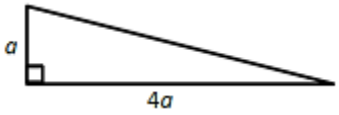
3) What is the area of a triangle formed by $x = 1$, $y = -2$, and $y = x$?

4) If (4, 0) and (0, 5) are two vertices of an isosceles right triangle, how many right triangles can this be true of?

5) The rectangle has a width of 5 units and an area of 75 square units. What is the length of the diagonal of the rectangle, in units?



6) The diagram shows a right triangle and the dimensions, in units, of its two legs

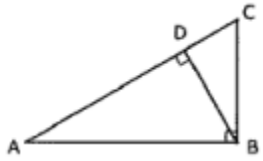


   a. Find the area of the triangle.

   b. Find the perimeter of the triangle.

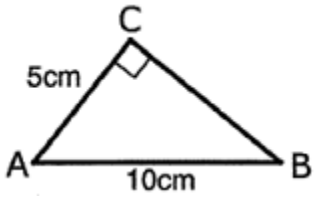
5.3 The Pythagorean Theorem - Answers

1) In right triangle *ABC*, *BD* is an altitude. If *AC* = 2 in and *BC* = 1 in, what is the length of *BD*?



Answer: $\frac{\sqrt{3}}{2}$

2) What is the exact value of the area of right triangle *ABC*?



Answer: $\frac{25\sqrt{3}}{2}$

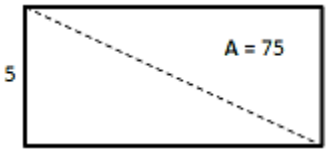
3) What is the area of a triangle formed by $x = 1$, $y = -2$, and $y = x$?

4 1/2 units^2

4) If (4, 0) and (0, 5) are two vertices of an isosceles right triangle, how many right triangles can this be true of?

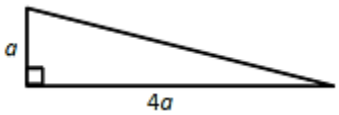
6

5) The rectangle has a width of 5 units and an area of 75 square units. What is the length of the diagonal of the rectangle, in units?



Answer: $5\sqrt{10}$

6) The diagram shows a right triangle and the dimensions, in units, of its two legs.



a. Find the area of the triangle. **Answer: 2a^2 units**

b. Find the perimeter of the triangle. **Answer:** $5a + a\sqrt{17}$ **units^2**

5.4 Surface Area and Volume of 3-D Figures - Questions

1) What is the surface area of a cube with an edge of one half inch?

2) What is the surface area of a cylinder with a circumference of 10π in. and a height of 8 in.? Answer in terms of π.

3) If the total surface area of a cube is 384 cm^2, what is the length of one edge?

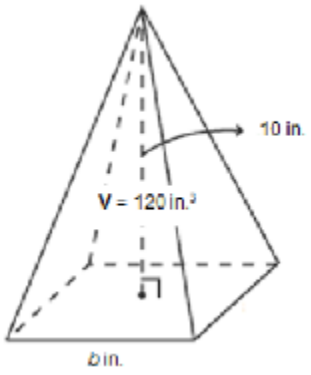
4) If the edges of a cube add up to 36 m, what is the volume?

5) Three tennis balls just fit in a cylindrical can. If each tennis ball is 2.5 inches in diameter, what is the volume of the can? Express in terms of π and round the decimal multiplier to the nearest tenth.

6) If the 3 base edges of a tetrahedron are 8 cm and the height is 6 cm, what is the volume? Express in simplified radical form.

7) If the volume of a sphere is $\frac{32\pi}{3}$ cm^3, what is the diameter?

8) The right square pyramid shown has a height of 10 inches and a volume of 120 cubic inches. What is the base length (*b*), in inches?



5.4 Surface Area and Volume of 3-D Figures - Answers

1) What is the surface area of a cube with an edge of one half inch?

   3/2 sq in

2) What is the surface area of a cylinder with a circumference of 10π in. and a height of 8 in.? Answer in terms of π.

   130π sq in

3) If the total surface area of a cube is 384 cm^2, what is the length of one edge?

   8 cm

4) If the edges of a cube add up to 36 m, what is the volume?

   27 m^3

5) Three tennis balls just fit in a cylindrical can. If each tennis ball is 2.5 inches in diameter, what is the volume of the can? Express in terms of π and round the decimal multiplier to the nearest tenth.

   11.7π in^2

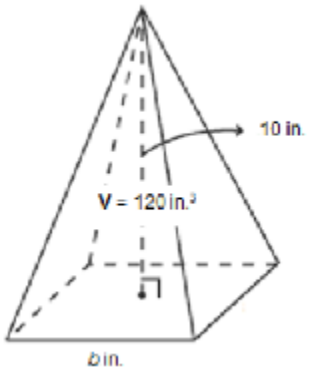
6) If the 3 base edges of a tetrahedron are 8 cm and the height is 6 cm, what is the volume? Express in simplified radical form.

   Answer: $32\sqrt{3}$ **cm^3**

7) If the volume of a sphere is $\frac{32\pi}{3}$ cm^3, what is the diameter?

   4 cm

8) The right square pyramid shown has a height of 10 inches and a volume of 120 cubic inches. What is the base length (*b*), in inches?



6 in

5.5 Simple Probability and the Counting Principle - Questions

1) Marcus made the basket 16 times and missed the basket 9 times in the basketball game. What is the probability that he will make the basket on his next try?

2) Sandy decorated her holiday tree with 10 red, 15 silver, and 5 green glass ornaments. Her little brother, Roger, pulled the tree over and only one ornament broke. What is the probably it was red?

3) Michael has a 60% chance of making a free throw in basketball. What is the probability that he makes three free throws in a row?

4) There are 6 people in a race. In how many ways can they finish first, second, or third?

5) In Canada, postal codes consist of 6 characters – three letters and three digits. Each postal code starts with a letter and alternates with a digit.

    a. How many postal codes are there?

    b. How many start with the letter S?

    c. How many start with the letter S and end in the digit 8?

6) There are 8 forks, 10 spoons, and 6 knives in Evelyn's kitchen drawer. How many different combinations of place settings (1 fork, 1 spoon, and 1 knife) can Evelyn make using the utensils in the drawer?

5.5 Simple Probability and the Counting Principle - Answers

1) Marcus made the basket 16 times and missed the basket 9 times in the basketball game. What is the probability that he will make the basket on his next try?

   0.64 or 64%

2) Sandy decorated her holiday tree with 10 red, 15 silver, and 5 green glass ornaments. Her little brother, Roger, pulled the tree over and only one ornament broke. What is the probably it was red?

   1/3 or 33 1/3%

3) Michael has a 60% chance of making a free throw in basketball. What is the probability that he makes three free throws in a row?

   0.216 or 21.6%

4) There are 6 people in a race. In how many ways can they finish first, second, or third?

   120

5) In Canada, postal codes consist of 6 characters – three letters and three digits. Each postal code starts with a letter and alternates with a digit.

   a. How many postal codes are there?

      17,576,000

   b. How many start with the letter S?

      676,000

   c. How many start with the letter S and end in the digit 8?

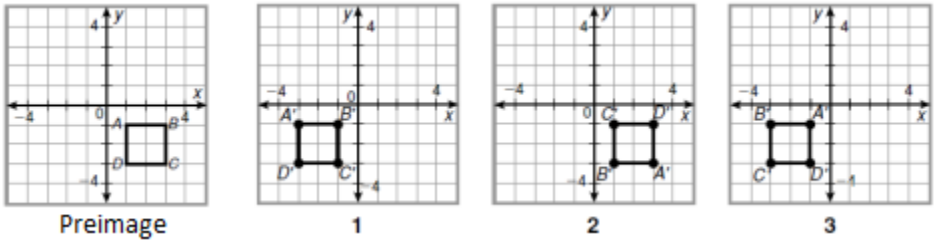
      67,000

6) There are 8 forks, 10 spoons, and 6 knives in Evelyn's kitchen drawer. How many different combinations of place settings (1 fork, 1 spoon, and 1 knife) can Evelyn make using the utensils in the drawer?

   480

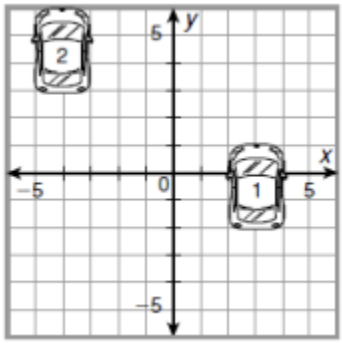
5.6 Transformations in the Coordinate Plane - Questions

1) The figure in the plane shows the preimage in the transformation *ABCD* → *A'B'C'D'*. Match the number of the image with the name of the correct transformation.

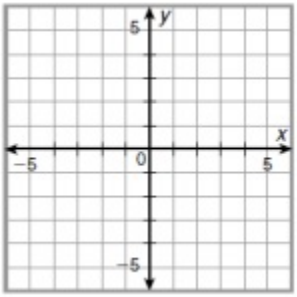


a) Rotation: _____ b) Translation: _____ c) Reflection: _____

2) A parking garage attendant will make the most money when the maximum number of cars fit in the parking garage. To fit one more car in, the attendant moves a car from position 1 to position 2. Write a rule for this translation.

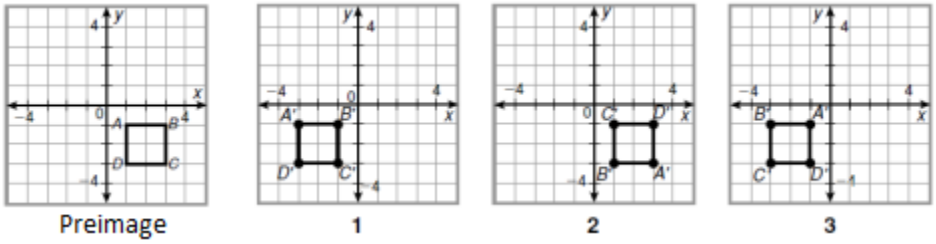


3) A figure has vertices at *X*(–1, 1), *Y*(–2, 3), and *Z*(0, 4). Draw the image of *XYZ* after the translation (*x*, *y*) → (*x*, *y* – 2) and a 180° rotation around *X*.



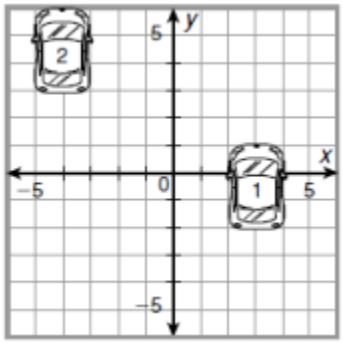
5.6 Transformations in the Coordinate Plane - Answers

1) The figure in the plane shows the preimage in the transformation *ABCD* → *A'B'C'D'*. Match the number of the image with the name of the correct transformation.



a. Rotation: **2** b) Translation: **1** c) Reflection: **3**

2) A parking garage attendant will make the most money when the maximum number of cars fit in the parking garage. To fit one more car in, the attendant moves a car from position 1 to position 2. Write a rule for this translation.



(x, y) → (x – 7, y + 5)

3) A figure has vertices at *X*(–1, 1), *Y*(–2, 3), and *Z*(0, 4). Draw the image of *XYZ* after the translation (*x*, *y*) → (*x*, *y* – 2) and a 180° rotation around *X*.

Answer: