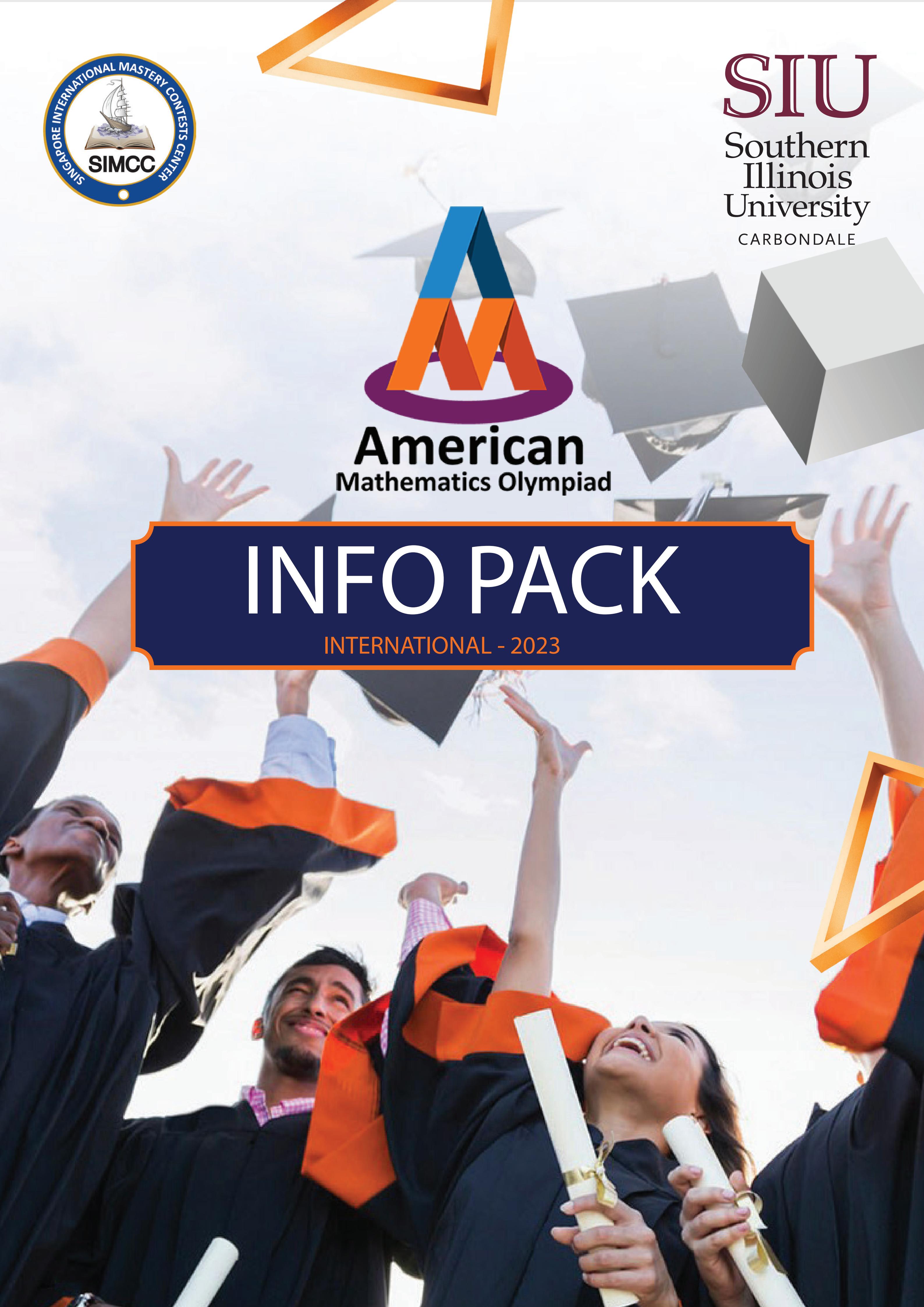


SINGAPORE INTERNATIONAL MASTERY CONTESTS CENTER
SIMCC

SIU
Southern Illinois University
CARBONDALE

American Mathematics Olympiad

INFO PACK

INTERNATIONAL - 2023

Syllabus

AMO reserves the rights to change the syllabus without any prior notice.

GRADE 2-4 (PRIMARY 2-4)

- Arithmetic and Statistics
- Geometry and Mensuration
- Solving word problems using model method (or any other non-algebraic methods)
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and simple cryptarithms)

GRADE 5-6 (PRIMARY 5-6)

- Arithmetic and Statistics
- Geometry and Mensuration
- Solving word problems using model method (or any other methods including algebra)
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and cryptarithms)

GRADE 7 (SECONDARY 1)

- Arithmetic and Algebra
- Geometry, Graphs and Mensuration
- Statistics
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and cryptarithms)

GRADE 8 (SECONDARY 2)

- Arithmetic and Algebra
- Geometry, Graphs and Mensuration
- Pythagoras' Theorem
- Statistics
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and cryptarithms)

GRADE 9-10 (SECONDARY 3-4)

- Arithmetic and Algebra
- Geometry, Graphs and Mensuration
- Pythagoras' Theorem and Trigonometry
- Statistics and Probability
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and cryptarithms)

GRADE 11-12 (JUNIOR COLLEGE 1-2)

- Arithmetic and Algebra
- Geometry, Graphs and Mensuration
- Pythagoras' Theorem and Trigonometry
- Statistics and Probability
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and cryptarithms)

Sample Questions

Grade 2-4 (Primary 2-4)

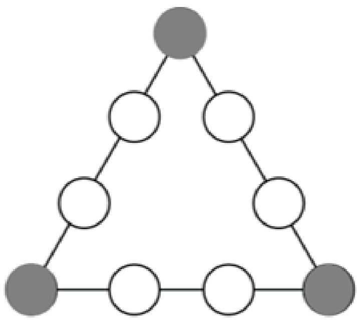
For more sample questions, visit https://form.simcc.org/lms-home/
Please register an account at our Member Development Portal (https://form.simcc.org/) to access the questions.

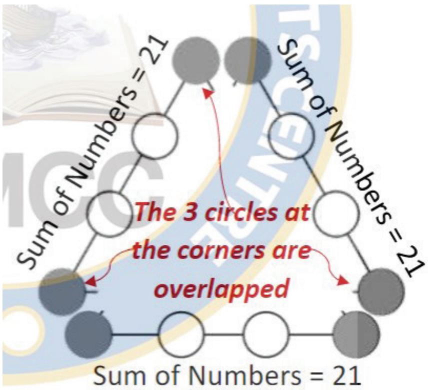
Grade 2/Primary 2: Jessie has 74 pieces of candy. Her friend Frank said: “If you give me 19 of your candies, we will both have the same number of candies”. How many pieces of candy does Frank have ?

Solution: If Jessie gives 19 of her candies to Frank, then she would have 74–19=55 candies left. If Frank receives 19 pieces of candy from Jessie, they will have both the same number of candies which is 55. Hence, Frank has 55–19= 36 pieces of candy.

Answer: 036

Grade 3/Primary 3: The numbers 1 through 9 are placed in the diagram, one in each circle. The sum of the numbers along each line is 21. What is the sum of the numbers in the shaded circles ?





Solution: Strategy: Find the total sum.Since the sum of numbers on each side is 21, then the total sum of numbers in the 12 circles (as shown on the right) is 21×3=63. Take note that each number in a shaded circle is counted twice in the sum 63. We also know that the sum of all 9 circles in the original diagram is 1+2+3+...+9=45. Thus, the sum of the numbers in the shaded circles is 63–45=18.

Answer: 018

Sample Questions

Grade 2-4 (Primary 2-4)

Grade 4/Primary 4: Annie is making pattern of dots. The first four figures are shown below. How many dots will the 7th figure contain ?

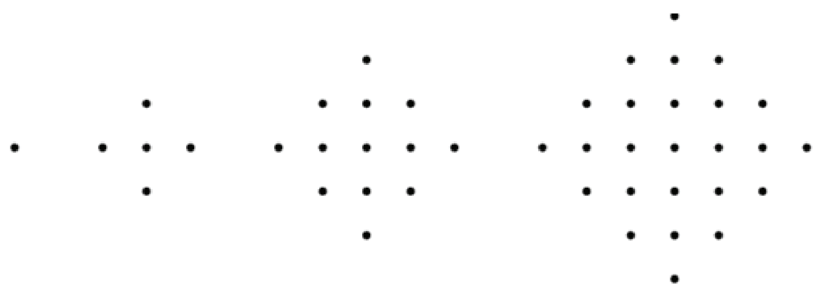


Figure 1 *Figure* 2 *Figure* 3 *Figure* 4

Solution: We can notice that the number of dots in Figure 4 is 1+3+5+7+5+3+1. Hence the number of dots in Figure 7 is 1+3+5+7+9+11+13+11+9+7+5+3+1=85.

Answer: 085

Sample Questions

Grade 5-6 (Primary 5-6)

For more sample questions, visit https://form.simcc.org/lms-home/
Please register an account at our Member Development Portal (https://form.simcc.org/) to access the questions.

Grade 5/Primary 5: In a family, there are four children. Adam's age is the sum of Beth's and Carol's ages. Four years ago, David's age was the sum of Beth's age then and Carol's age then. Eight years ago, Adam's age was twice David's age then. Who is the oldest child in this family ?

(Write 001 if Adam, 002 if Beth, 003 if Carol and 004 if David)

Solution:

METHOD 1 Strategy: Use logical reasoning.Since Adam's age is the sum of Beth's and Carol's ages, he must be older than either of them. Since 8 years ago Adam was twice David's age, Adam must be older than David. Therefore, Adam is the oldest child.

METHOD 2 Strategy: Make a table and use an algebraic approach.

Children	Adam	Beth	Carol	David
Age Now	$B + C$	B	C	D
4 years ago	$B + C - 4$	$B - 4$	$C - 4$	$D - 4$
8 years ago	$B + C - 8$	$B - 8$	$C - 8$	$D - 8$

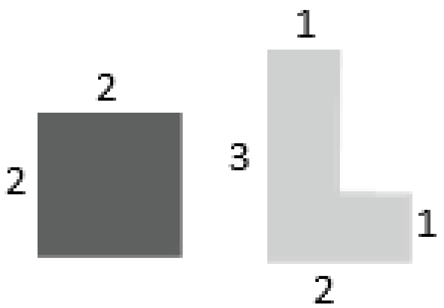
Set up 2 equations: $D - 4 = (B - 4) + (C - 4)$ and $B + C - 8 = 2(D - 8)$. Simplify these equations to: $D = B + C - 4$ and $B + C = 2D - 8$. Substitute the second equation into the first to get: $D = (2D - 8) - 4$ so $D = 12$. Since $D = (B + C) - 4$, $B + C = 16$. Since both Beth and Carol existed 4 years ago, they must each be at least 4 years old at this time so neither one is older than 12. Finally we are told that Adam was twice David's age at some time so Adam is older than David. Hence, Adam is the oldest child.

Answer: 001

Sample Questions

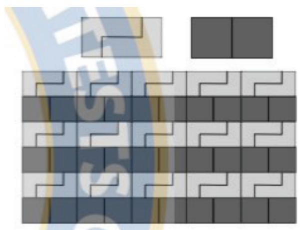
Grade 5-6 (Primary 5-6)

Grade 6/Primary 6: Ananya wants to tile a floor that is 24 m by 40 m. There are two types of tiles: a square that is 2 m on a side and an L-shape as shown. The L-shaped tile can be turned over or rotated if needed. What is the least number of tiles Ananya needs to tile the floor completely ?

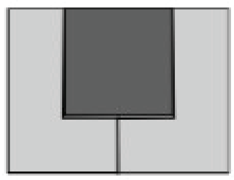


Solution: Let us show that the least number of tiles Ananyaneeds to tile 12 m by 20 m floor completely is 60. Then the least number needed to tile 24 m by 40 m floor is 4×60 = 240.

METHOD 1 Strategy: Use subdivisions of the area.First note that both the 2 x 2 and L-shape fill 4 units of area. Because the floor is 20 x 12 = 240 m^2, the best we can hope for is 240 ÷ 4 = 60 tiles. Now, let's put a few tiles together at a time. Two L-shapes can fill a 2 x 4 rectangle, if one L is flipped and rotated.Two 2 x 2 squares can also join to become a 2 x 4 rectangle. Either way, the 12 rows of the floor's grid can be filled by all squares, all L-shapes, or a combination of both. That would yield 6 row blocks by 5 column blocks, each with 2 matching tiles. That is, 6 x 5 x 2 = 60 tiles, the optimal solution. One possible arrangement is shown.



METHOD 2 Strategy: Use objects. Draw a grid of 20 x 12. Create L-shaped and square tiles as described in the problem (perhaps by tearing paper). The area of a square tile is 4, and the area of an L-shaped tile is also 4. Fifteen blocks comprised of four 2 x 2 tiles would fit on the grid (15 x 4 = 60). Thirty blocks comprised of two L-shaped tiles (one flipped and rotated) would also fit on the grid (30 x 2 = 60). Twenty blocks comprised of two L-shaped tiles and one square tile would also fit on the grid (20 x 3 = 60). Because both 12 and 20 are divisible by 4; 4 x 4, 2 x 4, and 3 x 4 rectangles can cover the grid. In any configuration, the least number of tiles that would coverthe floor would be 60.



Answer: 240

Sample Questions

Grade 7 (Secondary 1)

For more sample questions, visit https://form.simcc.org/lms-home/
Please register an account at our Member Development Portal (https://form.simcc.org/) to access the questions.

1) Find the sum of all the whole numbers between 41 and 50 inclusive, which are multiples of either 2 or 3 or 5.

Solution:

METHOD 1 Strategy: Make lists and eliminate duplicates.
Multiples of 2: 42, 44, 46, 48, 50
Multiples of 3: 42, 45, 48,
Multiples of 5: 45, 50.
Adding: $42 + 44 + 45 + 46 + 48 + 50 = 275$.
METHOD 2 Strategy: Add all the integers from 41 to 50 and subtract the ones that do not satisfy the conditions.

The sum of the numbers from 41 to 50 is $(10/2)\ (41 + 50) = 5(91) = 455$. Now subtract $455 - (41 + 43 + 47 + 49) = 455 - 180 = 275$.

Answer: 275

2) The sum of two non-consecutive page numbers is 70, and their difference is 36. Find their product.

Solution:
Let larger page number be x and the other page number be y.
Since the sum of these 2 pages are 70: $x + y = 70$.
Given that their difference is 36: $x - y = 36$

Adding the first equation to the next:
$x + y + x - y = 70 + 36$
$2x = 106$
$x = 53$
$y = 70 - 53 = 17$

Then their product are: $xy = 53 \times 17 = 901$

Answer: 901

Sample Questions

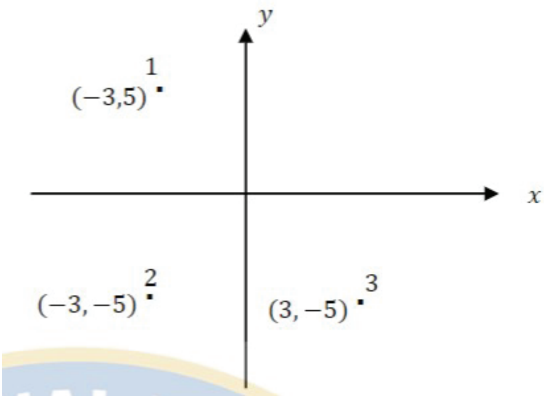
Grade 8 (Secondary 2)

For more sample questions, visit https://form.simcc.org/lms-home/
Please register an account at our Member Development Portal (https://form.simcc.org/) to access the questions.

1) The point (–3, 5) is reflected over the x-axis. Its image is then reflected over the y-axis to the point (a, b). Find the value of a-b.

Solution:

Point 1 represents the initial point. Point 2 represents the reflection of point 1 in the x-axis. Point 3 represents the reflection of point 2 in the y-axis.



$a - b = 3 - (-5) = 8$

Answer: 008

2) Beginning with 789, each subsequent term in a sequence is formed by summing the cubes of the digits of the previous term. Find the 2018th term.

Solution:
The next term after 789 is $7^3 + 8^3 + 9^3 = 1584$
The following term after 1584 is $1^3 + 5^3 + 8^3 + 4^3 = 702$

Repeating this method, the sequence is as follows:
789 , 1584, 702, 351, 153, 153, 153, ...

Thus the sequence repeats the term 153 after the 4th term. Hence at the 2018th term, the number will still be 153.

Answer: 153

Sample Questions

Grade 9/10/11/12 (Secondary 3/4/JC 1/2)

For more sample questions, visit https://form.simcc.org/lms-home/

Please register an account at our Member Development Portal (https://form.simcc.org/) to access the questions.

1) The triangle ABC is a right-angled triangle, where B is the right angle. BD is perpendicular to hypotenuse AC. Given AD = 8 cm and DC = 18 cm, what is the length of BD in cm ?

Solution:

Strategy: Pythagorean Theorem

Let the length BD be x

$AB^2 = x^2 + 8^2$, $BC^2 = x^2 + 18^2$

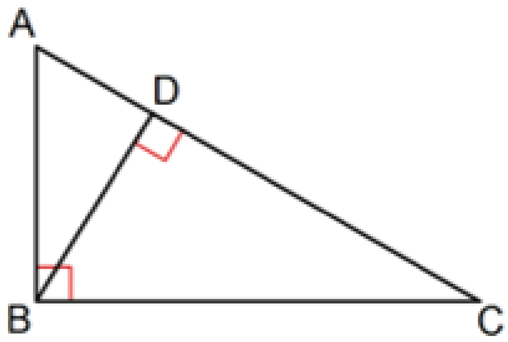
$AC^2 = AB^2 + BC^2$

$26^2 = x^2 + 8^2 + x^2 + 18^2$

$2x^2 = 288$

$x = 12.$

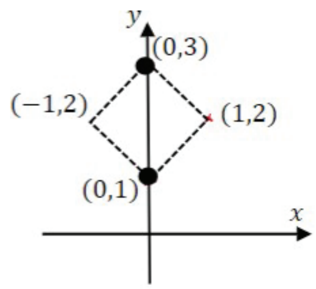
Answer: 012

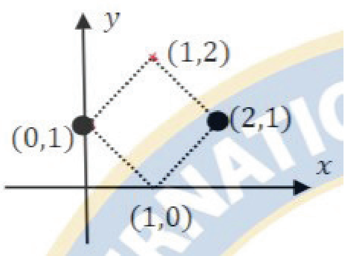


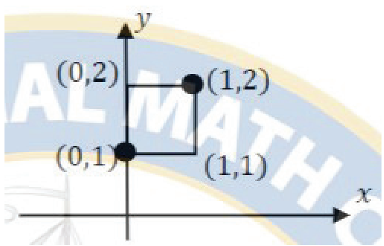
2) The points (0, 1) and (1, 2) are the coordinates of the adjacent corners of a square. Find the sum of the y-coordinates of the points diagonally opposite to (0, 1) in a square.

Solution:

From the graph below, by adding the point (−1,2) we can form a square, with it's vertices: (−1,2), (0,1), (1,2) and (0,3).Similarly, we can have another square with vertices:(1,0), (0,1), (1,2)and (2,1).Lastly, we can have another square with vertices:(0,2), (0,1), (1,2) and (1,1).







Therefore, the sum of y-coordinates diagonally opposite=3+2+1=6.

Answer: 006