Are you ready for Beast Academy 3B?

Before beginning Beast Academy 3B, a student should be able to classify polygons, skip-count, and understand the concepts of perimeter and area.

A student ready for Beast Academy 3B should be able to answer at least 9 of the 13 problems below correctly.

*Step 1.* The student should try to answer every question without a calculator and without help.

Step 2. Check the student's answers using the solutions at the end of this document.

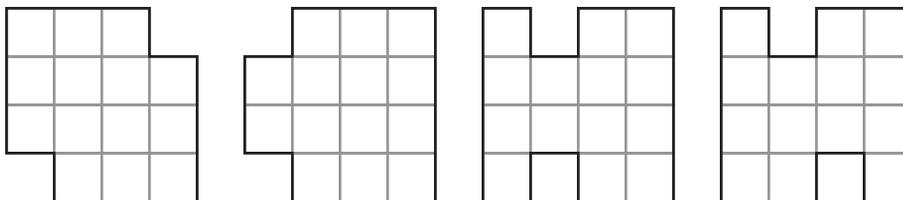*Step 3.* The student should be given a second chance on problems that he or she answered incorrectly.

1. Connect 3 of the points below to make an obtuse triangle.

2. Connect 4 of the points below to make a square.
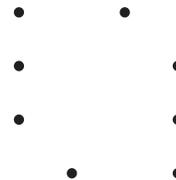
3. Circle the shape or shapes below that *cannot* be made with seven dominoes (▭).

Fill in the blanks to complete each skip-counting pattern below:

4. 5, 10, 15, _____, 25, _____, _____, 40, ...

5. 13, 19, _____, _____, _____, 43, 49, _____, 61, ...

**6.** _____, _____, 23, _____, 31, _____, _____, 43, ...

Answer each:

7. Ella begins at 9 and skip-counts by 7's. Jack begins at 9 and skip-counts by 8's. What is the next number that both Ella and Jack will say?
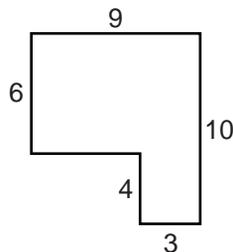
7. _____

8. What is the perimeter of a regular pentagon with sides of length 7?

8. _____

9. The height of a rectangle is increased by 3 inches. The new rectangle has a perimeter of 30 inches. What was the perimeter of the original rectangle?
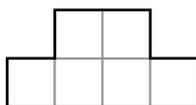
9. _____

10. What is the perimeter of the rectilinear shape below?

10. _____

```
      9
  ┌──────────┐
5 │          │
  │      ┌───┘
  └──────┘
```
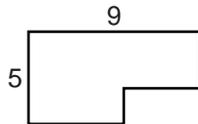
11. What is the area of the rectilinear shape below?

11. _____

```
        9
   ┌─────────┐
 6 │         │
   │      ┌──┘ 10
   │   4  │
   └──────┘
       3
```

12. Six squares are arranged as shown. The perimeter of each square is 5. What is the perimeter of the shape they make?

12. _____

13. One side of a triangle is 3 inches long. Another side of the same triangle is 6 inches long. Circle every value below that *could* be the length of the triangle's third side.
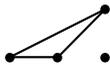
2 inches   5 inches   8 inches   11 inches   14 inches

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Solutions

1. An obtuse triangle must have one obtuse angle. There is only one way to connect three of the points to make an obtuse triangle, as shown below.

**2.** There is only one way to connect four of the points to make a square, as shown below:

3. If we color each shape with light and dark squares like a chess board, the first and fourth shapes each have 8 dark squares and 6 light squares. The second and third shapes have 7 light and 7 dark squares.
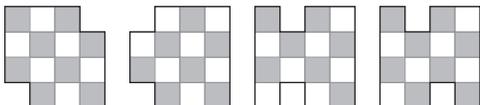
Since 7 dominoes will always cover 7 light squares and 7 dark squares, the **first and fourth shapes** are impossible to make with dominoes.
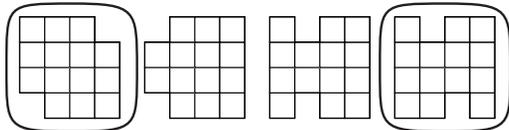
Below are possible ways to make the other two shapes.
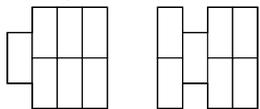
4. We skip-count by 5's, beginning at 5.

$$\overset{+5}{\frown}\ \overset{+5}{\frown}\ \overset{+5}{\frown}\ \overset{+5}{\frown}\ \overset{+5}{\frown}\ \overset{+5}{\frown}\ \overset{+5}{\frown}$$
5, 10, 15, **20**, 25, **30**, **35**, 40, ...

5. We skip-count by 6's, beginning at 13.

$$\overset{+6}{\frown}\ \overset{+6}{\frown}\ \overset{+6}{\frown}\ \overset{+6}{\frown}\ \overset{+6}{\frown}\ \overset{+6}{\frown}\ \overset{+6}{\frown}\ \overset{+6}{\frown}$$
13, 19, **25**, **31**, **37**, 43, 49, **55**, 61, ...

6. We look at the two closest numbers in the pattern: 23 and 31. We look for the number we can add to 23 twice to get 31. Because $31-23=8$, we need to add 8 to get from 23 to 31. Since $4+4=8$, we can add 4 twice to get 8. So, we are skip-counting by 4's.

$$\overset{+4}{\frown}\ \overset{+4}{\frown}\ \overset{+4}{\frown}\ \overset{+4}{\frown}\ \overset{+4}{\frown}$$
__, __, 23, **27**, 31, **35**, **39**, 43, ...

When skip-counting by 4's, we add 4 to get the next number. To get the previous number, we can do the opposite: subtract 4. We work backwards from 23 by subtracting to find the first two numbers in the pattern.

$$\overset{-4}{\frown}\ \overset{-4}{\frown}\ \overset{+4}{\frown}\ \overset{+4}{\frown}\ \overset{+4}{\frown}\ \overset{+4}{\frown}\ \overset{+4}{\frown}$$
15, **19**, 23, **27**, 31, **35**, **39**, 43, ...

7. We write the first few numbers Ella says:
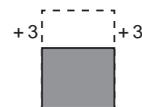9, 16, 23, 30, 37, 44, 51, 58, <u>65</u>, 72, 79, ...
We also write the first few numbers that Jack says:
9, 17, 25, 33, 41, 49, 57, <u>65</u>, 73, 81, ...
The next number that Ella and Jack both say is **65**.

8. A regular pentagon has 5 sides with equal length, so the perimeter of a regular pentagon with sides of length 7 is $7+7+7+7+7=$ **35**.

**9.** When we make a rectangle 3 inches taller, the length of each vertical side increases by 3.

So, the perimeter of the original rectangle is 6 inches *less* than the perimeter of the new rectangle. The new rectangle has a perimeter of 30 inches, so the perimeter of the original rectangle is $30-6=$ **24 inches**.

10. The short sides on the right side of the figure must add up to 5, and the short sides on the bottom of the figure must add up to 9, so the perimeter of the shape is the same as the perimeter of a 5 by 9 rectangle:

$(9+5)+(9+5)=14+14=$ **28**.

11. We can split the rectilinear shape into two rectangles as follows:
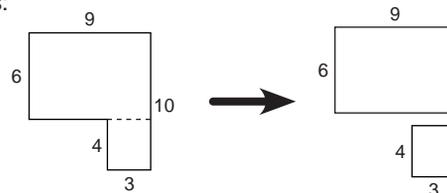
The area of the 6 by 9 rectangle is $9+9+9+9+9+9=54$ squares.
The area of the 4 by 3 rectangle is $4+4+4=12$ squares.
The area of the original shape is
$54+12=$ **66 (squares)**.

12. Each square has 4 sides, and it takes 12 of those sides to make the perimeter of the new shape. $4+4+4=12$, so this is the same as the number of sides in three squares. Since the perimeter of each square is 5, the perimeter of the new shape is $5+5+5=$ **15**.

13. The sum of the two shortest sides of a triangle must be greater than the length of the longest side. If 6 is the longest side of the triangle, then the third side must be longer than $6-3=3$ inches. If the third side of the triangle is the longest, it must be shorter than $3+6=9$ inches. This leaves two possible lengths in the list:

2 inches (5 inches) (8 inches) 11 inches 14 inches