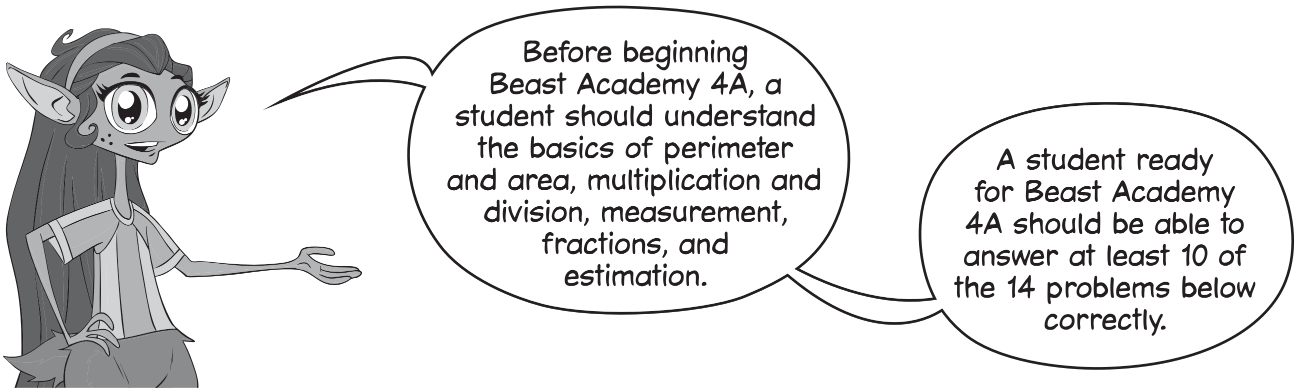
Are you ready for Beast Academy 4A?



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.

Compute.

1. $27 \times 6 =$ _________

2. $199 \times 80 =$ _________

Compute the quotient and remainder for each division expression.

3. $65 \div 11$

3. Quotient: _____ Remainder: _____

4. $196 \div 9$

4. Quotient: _____ Remainder: _____

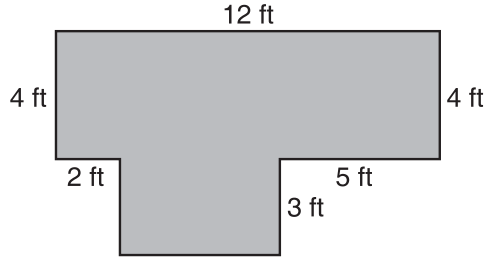
5. A regular hexagon has a perimeter of 108 inches and side length n inches. What is the value of n?

5. $n =$ _________

6. Find the perimeter and area of the rectilinear figure below.

6. Perimeter: _________

Area: _________



7. How many square feet are there in 2 square yards?

7. _________

8. Compute $(85 \times 85) - (84 \times 84)$.

8. _________

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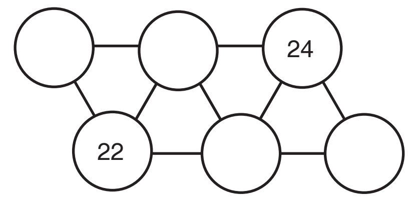
9. Place each of the four numbers below in one of the empty circles in the diagram on the right so that no two connected circles have a sum that has remainder 0 when divided by 5.

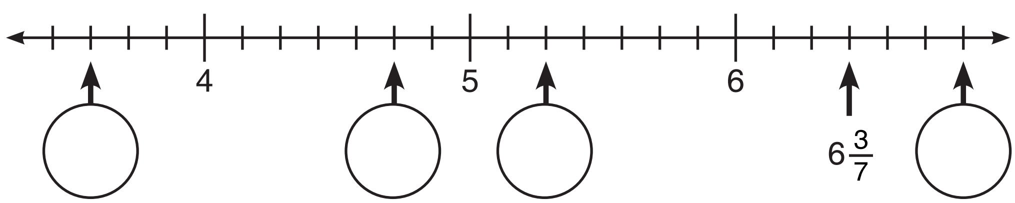
Missing Numbers: 26, 27, 28, 29



10. Connect each expression on the left to an equal value on the right by estimating the value of each product.

13×57 •	• 2,001
23×87 •	• 1,331
11×121 •	• 741

11. Label each value on the number line below with a mixed number in simplest form.

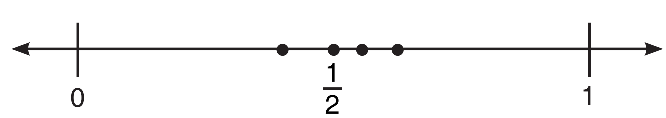


12. The fraction $\frac{25}{9}$ is closest to which whole number?

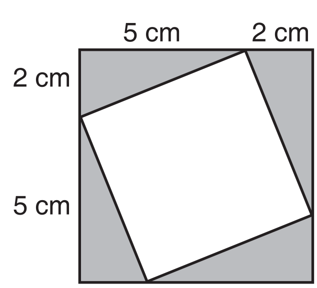
12. ________

13. Use the given fractions to label the three unlabled points on the number line below:

Fractions: $\frac{5}{9}$, $\frac{5}{8}$, $\frac{2}{5}$



14. Four congruent right triangles are arranged as shown to form a large square, with a smaller tilted square within. What is the area of the tilted square?



14. ______ square cm

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Solutions

1. $27\times6=(20+7)\times6=(20\times6)+(7\times6)=120+42=\mathbf{162}$.

2.
$$\begin{aligned}199\times80&=(200-1)\times80\\&=(200\times80)-(1\times80)\\&=16{,}000-80\\&=\mathbf{15{,}920}.\end{aligned}$$

3.
$$\begin{array}{r} 5\\ 11\,\overline{)\,65}\\ -55\\ \hline 10\end{array}$$

The quotient of $65\div11$ is **5**, and the remainder is **10**.

4.
$$\begin{array}{r} 20+1\\ 9\,\overline{)\,196}\\ -180\\ \hline 16\\ -9\\ \hline 7\end{array}$$

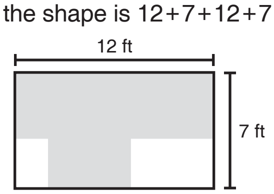
The quotient of $196\div9$ is $20+1=\mathbf{21}$, and the remainder is **7**.

5. A regular hexagon has 6 sides of equal length. To find the length of each side, we divide its perimeter by 6.

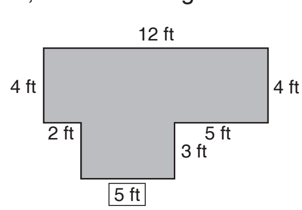
$$\begin{array}{r} 10+8\\ 6\,\overline{)\,108}\\ -60\\ \hline 48\\ -48\\ \hline 0\end{array}$$

$108\div6$ has remainder 0, so $108\div6=10+8=18$.
The side length of a regular hexagon with a perimeter of 108 inches is 18 inches. So, $n=\mathbf{18}$.

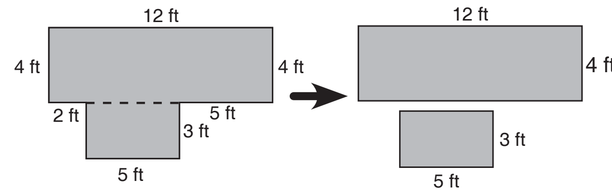
6. The short sides on the left side of the rectilinear shape must add up to the same length as the short sides on the right side of the shape ($3+4=7$ ft). The short sides on the bottom of the rectilinear shape must add up to the same length as the long side on top (12 ft). So, the shape has the same perimeter as a 12 ft by 7 ft rectangle. The perimeter of the shape is $12+7+12+7=$ **38 feet.**



To find the area of the shape, we begin by finding the length of the missing short side on the bottom of the shape. The width of the rectilinear shape is 12 feet.
$2+\boxed{5}+5=12$, so the missing horizontal length is 5 ft.



We split the shape into two rectangles.



The area of the 12 ft by 4 ft rectangle is $12\times4=48$ sq ft.
The area of the 5 foot by 3 foot rectangle is $5\times3=15$ sq ft. The total area of the rectilinear shape is $48+15=$ **63 square feet (sq ft)**.

7. A square yard is 3 ft by 3 ft. So, there are $3\times3=9$ square feet in 1 square yard.
In 2 square yards, there are $2\times9=$ **18 square feet (sq ft)**.

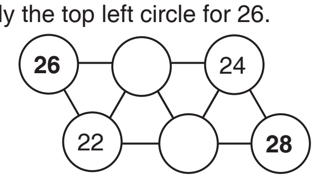
8. We don't need to compute (85×85) and (84×84) to find their difference. We can get from one perfect square to the next by adding. See Beast Academy 3B for a more thorough explanation.

To get from 84×84 to 85×84, we add 84.
To get from 85×84 to 85×85, we add 85.
So, $(84\times84)+84+85=(85\times85)$.

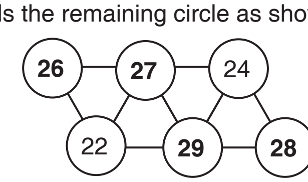
This means that (85×85) is $84+85=169$ more than (84×84).

Therefore, $(85\times85)-(84\times84)=\mathbf{169}$.

9. If a number ends in a 0 or a 5, then its remainder is 0 when divided by 5. We cannot place two numbers whose sum ends in 0 or 5 in connected circles.
$28+22=50$, so 28 cannot be connected to 22. This leaves only the bottom right circle for 28.
$26+24=50$, so 26 cannot be connected to 24. This leaves only the top left circle for 26.



Then, $27+28=55$, so 27 cannot be connected to 28.
That leaves only the top middle circle for 27.
The 29 fills the remaining circle as shown.



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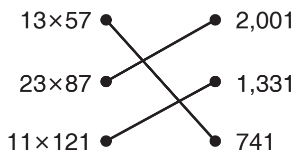
10. We estimate the products on the left:
$13\times57\approx10\times60=600$,
$23\times87\approx20\times90=1{,}800$, and
$11\times121\approx10\times120=1{,}200$.

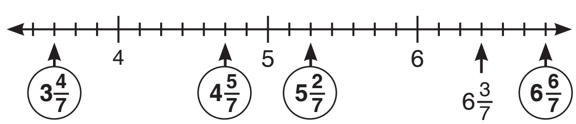
Then, we compare these estimates to the values on the right. Since 600 is closest to 741, we connect 13×57 to 741. Since 1,800 is closest to 2,001, we connect 23×87 to 2,001. Since 1,200 is closest to 1,331, we connect 11×121 to 1,331.



11. The tick marks split the number line into 7 equal pieces between each whole number. So, the tick marks identify sevenths on the number line.

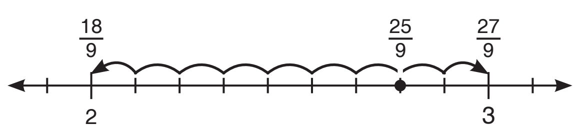
The far-right arrow marks six sevenths more than 6, so we label it $6\frac{6}{7}$. The middle-right arrow marks two sevenths more than 5, so we label it $5\frac{2}{7}$. The middle-left arrow marks five sevenths more than 4, so we label it $4\frac{5}{7}$.

The far-left arrow marks three sevenths less than $4=\frac{28}{7}$, so the left arrow marks $\frac{25}{7}$. Since $\frac{21}{3}=3$, $\frac{25}{7}$ is four sevenths more than 3. We label the far-left arrow $3\frac{4}{7}$.



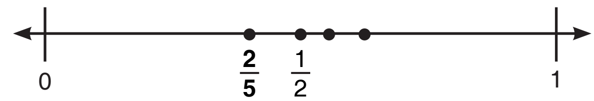
12. $\frac{25}{9}$ is between $\frac{18}{9}=2$ and $\frac{27}{9}=3$.

$\frac{25}{9}$ is two ninths from $\frac{27}{9}$ and seven ninths from $\frac{18}{9}$.

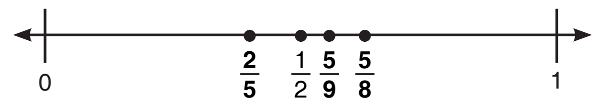


So, $\frac{25}{9}$ is closest to $\frac{27}{9}=\mathbf{3}$.

13. Only one marked point on the number line is less than $\frac{1}{2}$. Since $\frac{2}{5}$ is the only given fraction whose numerator is less than half its denominator, $\frac{2}{5}$ is the only fraction that is less than $\frac{1}{2}$:



Eighths are larger than ninths, so $\frac{5}{8}>\frac{5}{9}$. We label the points as shown:

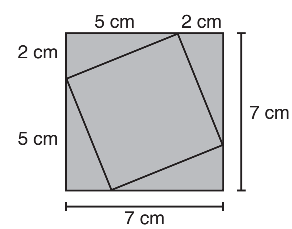


You may have also converted $\frac{5}{8}$ and $\frac{5}{9}$ to equivalent fractions with the same denominator to compare them: $\frac{5}{8}=\frac{45}{72}$ and $\frac{5}{9}=\frac{40}{72}$. Since $\frac{45}{72}>\frac{40}{72}$, we have $\frac{5}{8}>\frac{5}{9}$.

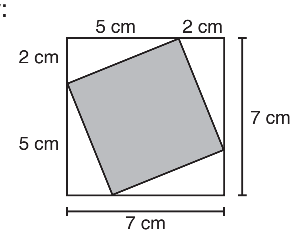
14. The side length of the large square formed by attaching the triangles is $5+2=7$ centimeters.

We calculate the area of the tilted square by subtracting the areas of the 4 congruent right triangles from the area of the larger square they create.

The area of the larger square is $7\times7=49$ sq cm. This is the shaded area below:



The area of each congruent triangle is $2\times5\div2=10\div2=5$ sq cm. The total area of the four triangles is therefore $4\times5=20$ sq cm. Subtracting the areas of the four triangles, we are left with the shaded area below:



The area of the tilted square is $49-20=$ **29 square cm**.