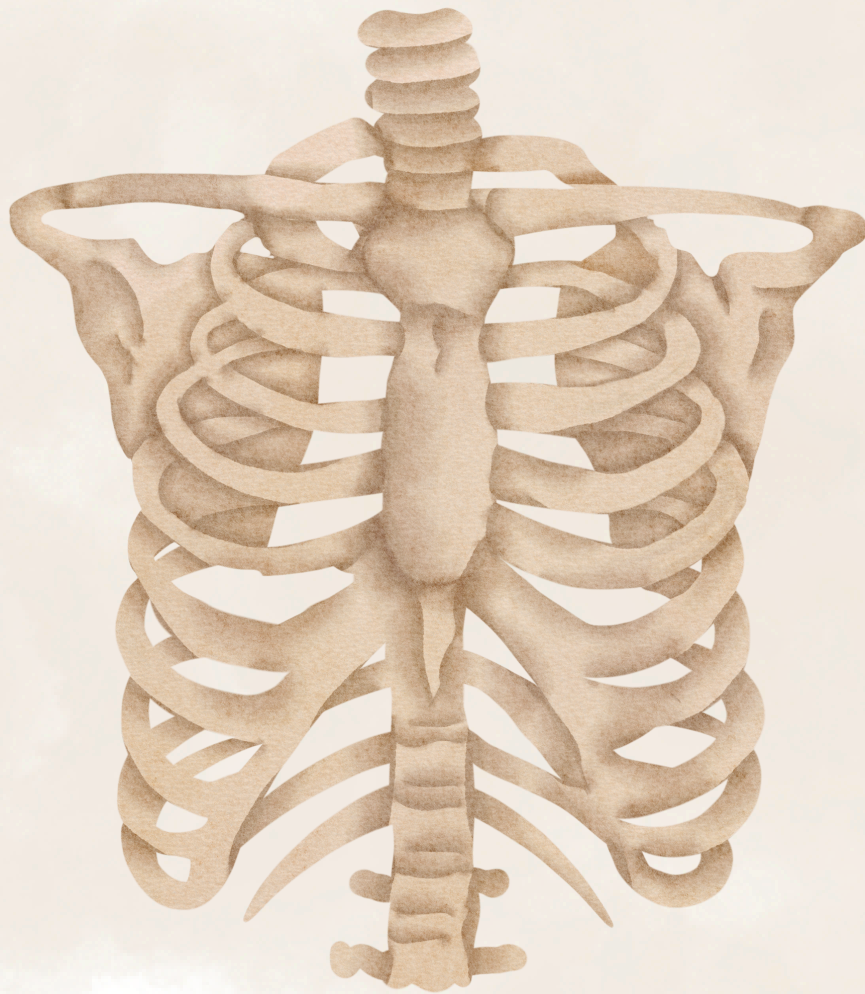


under the skin **MATH PROJECT**

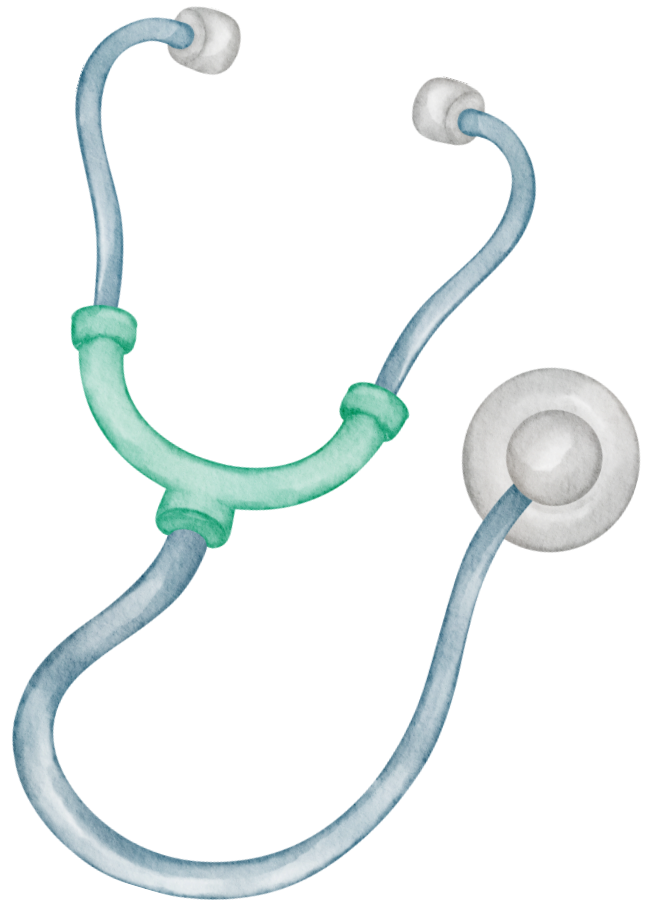


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UNDER THE SKIN

anatomy arithmetic

Let's get "under the skin"! In this math project, you will become a doctor for a day, using your math skills to solve real-world problems related to the human body. You'll need to use addition, subtraction, multiplication, division, and other math concepts to help keep our bodies healthy. Along the way, you'll see how math is a key part of understanding how our bodies work. Get ready to put on your lab coat and get to work!

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Comprehensive Level (generally grades 4th-6th)

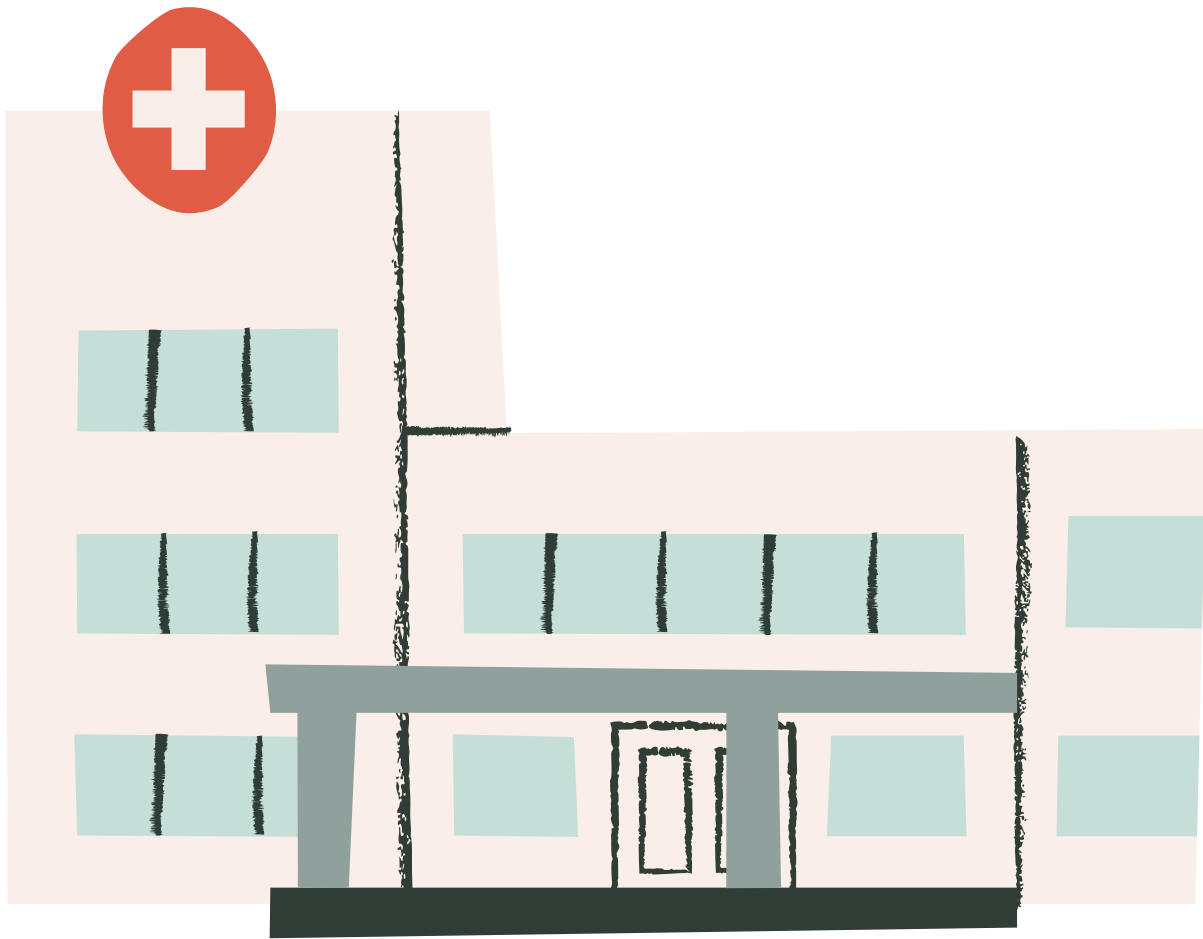
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MATH TOPICS ADDRESSED	Primary	Post-Primary	Comprehensive
Develop a concept of numeracy through play	✓		
Follow simple step-by-step directions	✓		
Skip-counting by 2's, 5's, 10's, and 100's.	✓		
Decomposition of numbers 0-10.	✓		
Addition and subtraction algorithms	✓	✓	✓
Multiplication and division with natural numbers	✓	✓	✓
Understanding of the concept of percentages			✓
Practice operations in versatile situations	✓	✓	✓

P = PRIMARY (generally grades K-1)

PP = POST-PRIMARY (generally grades 2-3)

C = COMPREHENSIVE (generally grades 4-6)



Get ready, MATH-medics!

Your exciting journey through the human body is about to begin. Put on your lab coat, grab your stethoscope, and prepare to explore the fascinating world of anatomy!

This math project is divided into three “floors” (or units) of the hospital:

1st Floor: Neurology – The Brain & Nervous System

2nd Floor: Cardiology – The Heart & Circulatory System

3rd Floor: Orthopedics – The Bones & Muscles

Get ready to unlock the mysteries of the human body with your amazing math abilities!

ALL LEVELS



Neurologist reviewing brain scans



Cardiologist listening to a heartbeat



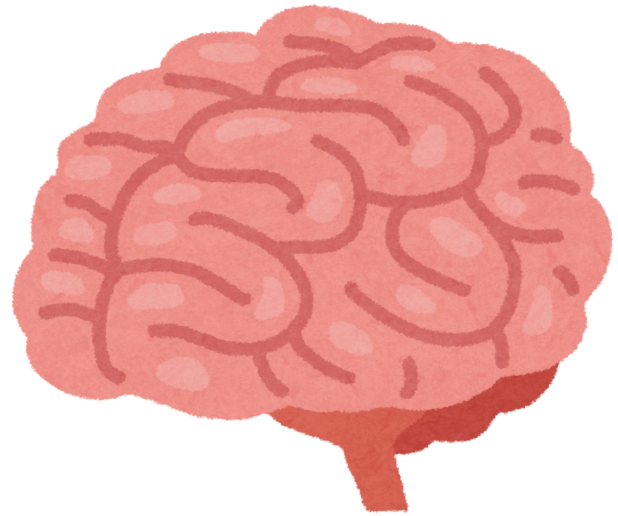
Orthopedic surgeon operating on a knee

NEUROLOGY

MEDICINE OF THE BRAIN & NERVES

What Neurologists Do:

A neurologist is a doctor who takes care of the brain, spinal cord, and nerves. These parts of the body are very important because they help us think, move, feel, and react to the world around us!



What They Treat:

- **Brain Problems:** If someone has a headache, memory problems, or trouble focusing, a neurologist can help figure out what's going wrong.
- **Nerve Issues:** They also help with conditions that affect the nerves, like if you feel numbness or tingling in your hands or feet.
- **Movement Disorders:** Neurologists can help with problems related to movement, like if someone has difficulty walking or has shaking hands.

If someone falls and hits their head, a neurologist might check to see if they have a concussion, which is a type of brain injury.

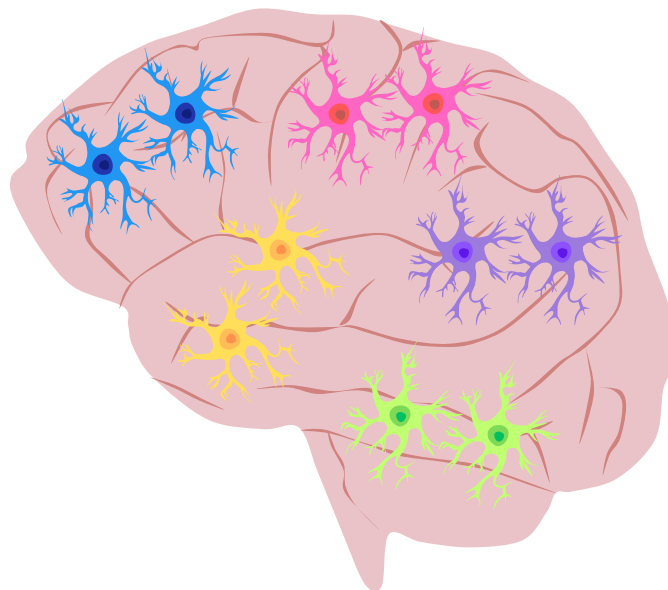
COUNTING NEURONS

You have a brain full of neurons, which are like tiny messengers.
Let's count how many neurons are in the brain!

Imagine your brain has 5 groups of neurons. Each group has 2 neurons.
How many neurons are there in total?

You can use **grouping** to think about it as
5 groups $\times$ 2 neurons. You can also use
skip counting: 2 neurons + 2 neurons + 2
neurons + 2 neurons + 2 neurons.

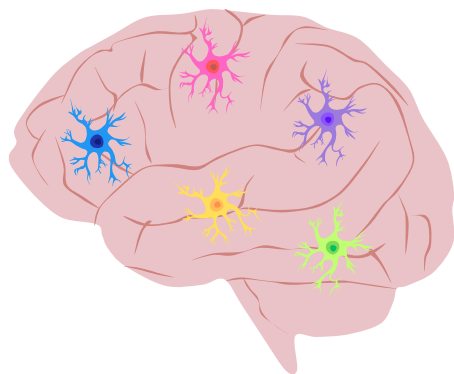
Answer: 10 neurons



YOUR TURN!

Directions: Write the number of neurons for each brain.

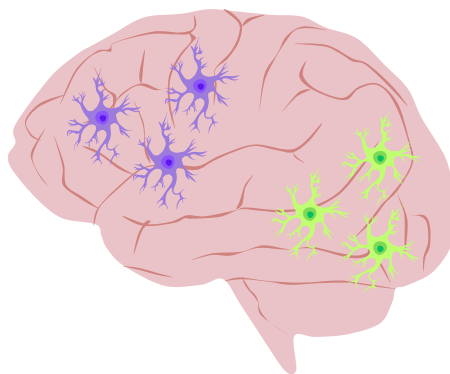
Challenge: Write a skip counting or grouping sentence that matches the brain.



_____ neurons

_____ $\times$ _____ = _____

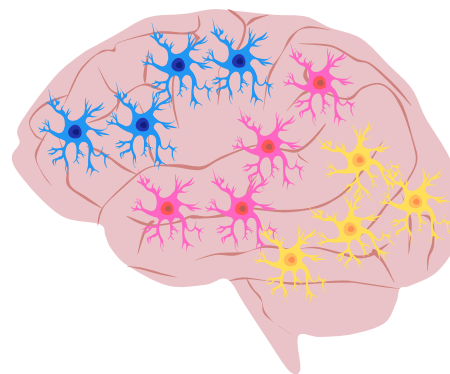
_____ + _____ + _____ + _____ + _____ = _____



_____ neurons

_____ $\times$ _____ = _____

_____ + _____ = _____



_____ neurons

_____ $\times$ _____ = _____

_____ + _____ + _____ = _____

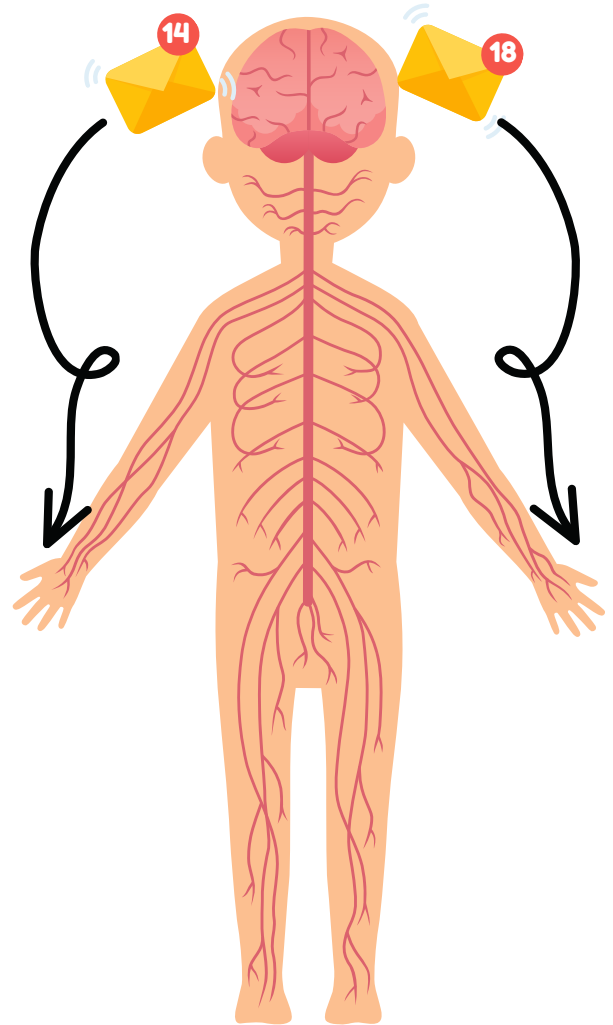
NERVOUS SYSTEM PATHWAYS

The brain sends messages to your body through pathways! Your job is to figure out how many messages travel through the pathways.

Your brain sends 14 messages to your right hand and 18 to your left hand. How many total messages does your brain send?

$$\begin{array}{r} 14 \\ +18 \\ \hline \end{array}$$

Answer: **32 messages**



YOUR TURN!

Directions: Answer the following questions.

Your brain sends 12 messages to your right foot and 20 messages to your left foot. How many total messages does your brain send to both feet? _____ messages

Then, 7 messages are sent back from your feet to your brain. How many messages are left? _____ messages

Your brain sends 25 messages to your eyes and 10 messages to your ears. How many total messages does your brain send to your eyes and ears? _____ messages

Later, 8 messages are sent back from your eyes and ears to your brain. How many messages are left? _____ messages

NEURON CONNECTION

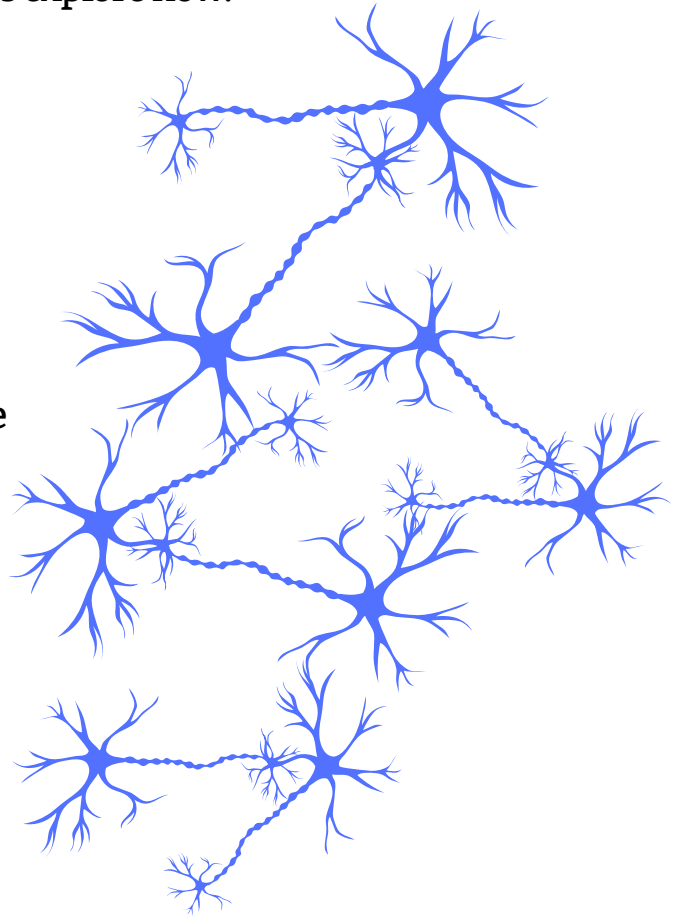
Neurons communicate with each other, but did you know each neuron can connect with thousands of other neurons? Let's explore how.

If each neuron connects to 250 other neurons, how many connections are there in total in a group of 12 neurons? (Hint: $12 \times 250 = ?$)

Answer: 3,000 connections

If we have 3,000 neurons, how many complete groups of 250 connections can we make? (Hint: $3,000 \div 250 = ?$)

Answer: 12 groups



YOUR TURN!

Directions: Answer the following questions.

If each neuron connects to 300 other neurons, how many connections are there in total in a group of 15 neurons? _____ connections

If we have 4,500 neurons, how many complete groups of 300 connections can we make? _____ groups

If each neuron connects to 150 other neurons, how many connections are there in total in a group of 20 neurons? _____ connections

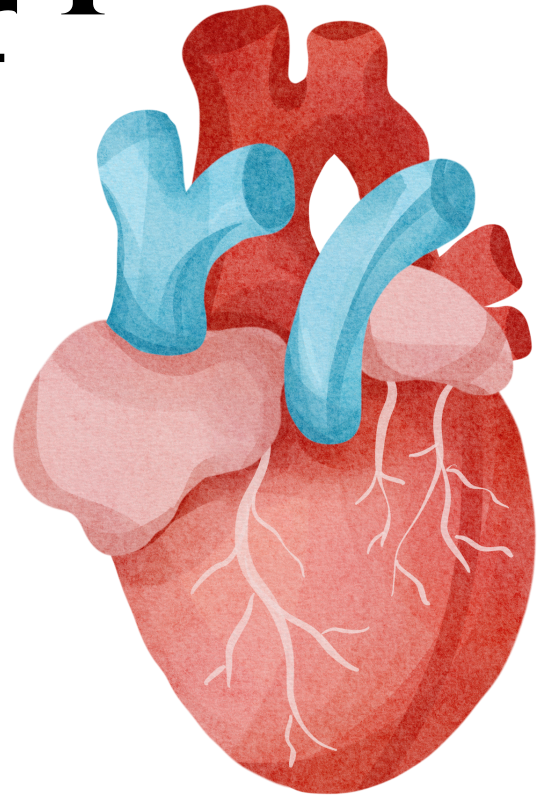
If we have 6,000 neurons, how many complete groups of 150 connections can we make? _____ groups

CARDIOLOGY

MEDICINE OF THE HEART

What They Do:

A cardiologist is a doctor who takes care of your heart and blood vessels. Your heart is the pump that sends blood throughout your body, and the blood carries oxygen and nutrients to all your organs and muscles.



What They Treat:

- **Heart Problems:** Cardiologists help people who have heart problems like chest pain, heart disease, or irregular heartbeats.
- **Blood Vessel Issues:** They also help with problems in the blood vessels, like when someone has high blood pressure (the force of blood moving through your arteries is too high).
- **Heart Checkups:** Cardiologists do tests to make sure the heart is pumping blood properly and to prevent future heart problems.

If someone has trouble breathing or gets really tired quickly, a cardiologist might check their heart to make sure it's healthy and pumping blood well.

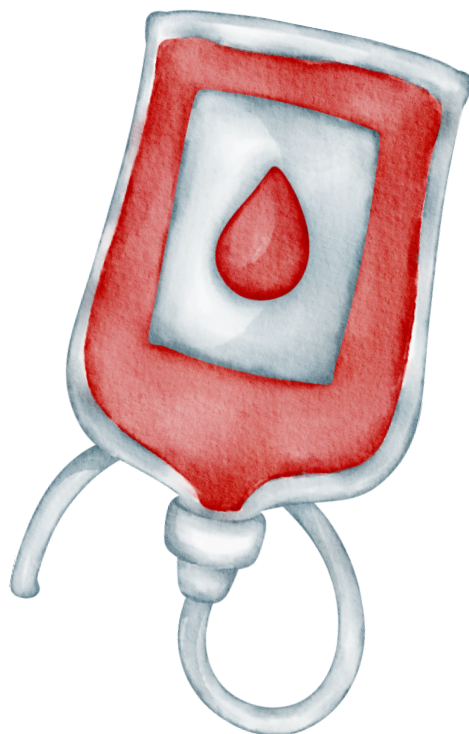
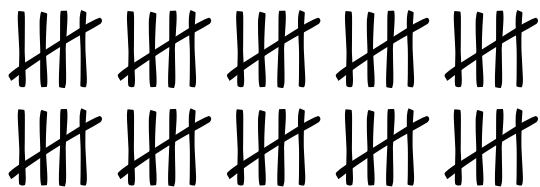
BLOOD FLOW MEASUREMENT

Your heart pumps blood throughout your body. Let's keep track of how many liters of blood the heart pumps.

The heart pumps 5 liters of blood every minute. If it pumps for 10 minutes, how many liters of blood are pumped?

You can use **grouping** to think about it as $5 \text{ liters} \times 10 \text{ minutes}$. You can also use **skip counting**: $5 \text{ L} + 5 \text{ L} + 5 \text{ L} + 5 \text{ L} + 5 \text{ L} + 5 \text{ L} + 5 \text{ L} + 5 \text{ L} + 5 \text{ L} + 5 \text{ L}$.

Answer: **50 liters**



YOUR TURN!

Directions: Answer the following questions.

The heart pumps 3 liters of blood every minute. How much blood does it pump in 5 minutes? _____ liters

Your heart pumps 6 liters of blood each minute. How many liters of blood does it pump in 3 minutes? _____ liters

If the heart pumps 4 liters of blood each minute, how much blood will be pumped in 8 minutes? _____ liters

HEARTBEAT COUNTING

Your heart beats many times a minute! Let's count how many times your heart beats in 10 seconds.

Step 1: Learn how to find your pulse.

Have your parent show you how to find your pulse on your wrist or your neck.

Step 2: Set a timer for 10 seconds.

Count how many times your heart beats until the timer goes off.

My heart beat _____ times in 10 seconds.

YOUR TURN!

Directions:

Using the 10-second heart rate you just discovered, answer these questions:

1. How many times does your heart beat in half a minute? _____
2. How many times does your heart beat in a full minute? _____
3. How many times does your heart beat in 5 minutes? _____
4. How many times does your heart beat in 1 hour? _____
5. **CHALLENGE:** How many times does your heart beat in 1 DAY? _____



BLOOD VOLUME AND HEARTBEATS

The heart is an amazing pump! It sends blood throughout the body to keep you healthy and energized. Let's see how much blood the heart sends out in a longer period of time.

The heart pumps 80 milliliters of blood per beat.

If the heart beats 60 times in one minute, how much blood is pumped in that minute?

(Hint: $80 \times 60 = ?$)

$$\begin{array}{r}
 80 \\
 \times 60 \\
 \hline
 00 \\
 + 480 \\
 \hline
 4800 \text{ mL}
 \end{array}$$



YOUR TURN!

Directions: Answer the following questions.

If the heart pumps 4,800 milliliters of blood in one minute, how many liters of blood is that? _____ milliliters

The heart pumps 90 milliliters of blood per beat. If the heart beats 65 times in one minute, how much blood is pumped in 5 minutes? _____ milliliters

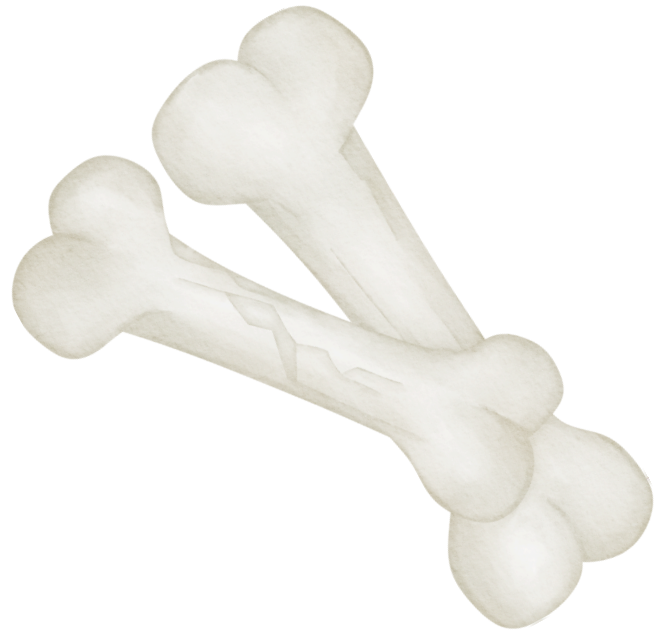
The heart pumps 100 milliliters of blood per beat. If the heart beats 50 times in one minute, how much blood is pumped in 10 minutes? _____ milliliters

ORTHOPEDICS

MEDICINE OF THE BONES, MUSCLES, & JOINTS

What Orthopedists Do:

An orthopedic doctor (or orthopedist) takes care of your bones, muscles, and joints. These parts of your body help you move, stay strong, and do everyday activities like running, jumping, or even sitting!



What They Treat:

- **Broken Bones:** If you break a bone while playing or get hurt, an orthopedic doctor helps it heal.
- **Joint Problems:** If your knees, elbows, or other joints hurt or don't move properly, an orthopedic doctor can help fix the problem.
- **Muscle Issues:** Orthopedic doctors also help with muscle injuries or problems, like if you pull a muscle while playing sports.

If someone sprains their ankle while playing soccer, an orthopedic doctor would help them recover and get back on their feet.

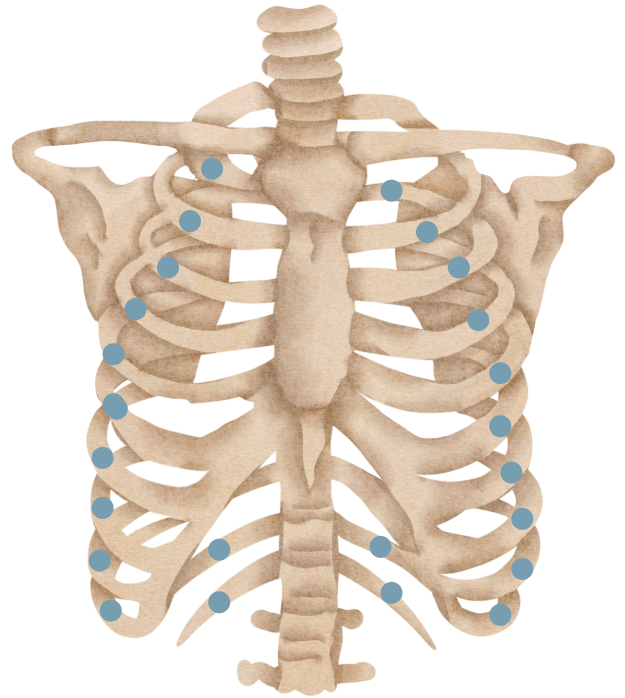
BONE COUNTING

The human body has many bones. Let's count how many bones you have in different parts of your body!

Count how many rib bones altogether.

Answer: 24 rib bones

How many rib bones are there on just one side?



YOUR TURN!

Directions: Answer the following questions.

Count how many bones in the hand to the right.

_____ bones

How many bones in both hands altogether?

_____ bones

If you lost your entire thumb, how many bones would you have left in your hand?

_____ bones



MUSCLE STRENGTH

Muscles help you move! How many muscles do you use when you pick up objects?

You use 5 muscles to lift a small box and 10 muscles to lift a medium box. If you lift 3 small boxes and 4 medium boxes, how many muscles do you use in total?

$$\begin{array}{r}
 5 \times 3 = 15 \\
 10 \times 4 = + 40 \\
 \hline
 55 \\
 \text{muscles}
 \end{array}$$



YOUR TURN!

Directions: Answer the following questions.

You use 12 muscles for each push-up, and you do 15 push-ups. How many muscles do you use in total for all the push-ups? _____ muscles

You use 7 muscles to carry a light grocery bag and 12 muscles to carry a heavy grocery bag. If you carry 4 light grocery bags and 3 heavy grocery bags, how many muscles do you use in total? _____ muscles

You use 6 muscles to do each sit-up and 9 muscles to do each leg raise. If you do 10 sit-ups and 8 leg raises, how many muscles do you use in total? _____ muscles

You use 8 muscles to stretch your arms and 5 muscles to stretch your legs. If you stretch your arms 6 times and your legs 5 times, how many muscles do you use in total? _____ muscles

BONE LENGTH

The human skeleton is made of bones that weigh a lot together! Let's figure out the total mass of bones in the human body.

An average human arm bone (humerus) is 15 inches long. If an orthopedic surgeon needs to create prosthetic humerus bones for a group of 150 patients, how many total inches of humerus bones will the surgeon need to make?

2,250 inches

YOUR TURN!

Directions: Answer the following questions.

The average length of a human femur bone is 19 inches. For the same group of 150 patients, how many total inches of femur bones will the surgeon need?

_____ inches

Let's combine the total lengths of both the humerus and femur. Add the totals from Step 1 and Step 2 together to find the total combined length of humerus and femur bones for all 150 patients.

_____ inches

The surgeon needs to add a 5% increase in the length of each prosthetic bone to ensure they fit correctly and provide proper movement. How much longer will each prosthetic humerus and femur be after the 5% increase?

_____ inches

After the 5% increase, how much total length of prosthetic bones will the surgeon need for all 150 patients, combining both the humerus and femur?

_____ inches



*You did it! You
make a great
doctor. Keep
practicing your
math skills and
helping people get
better!*



