

# The Hard Stuff! All About Bones

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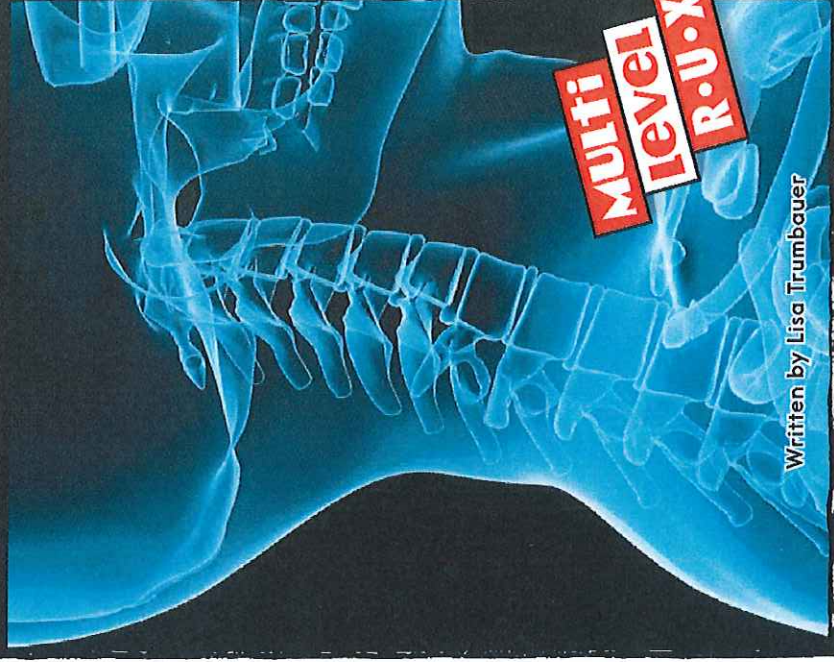


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# The Hard Stuff! All About Bones



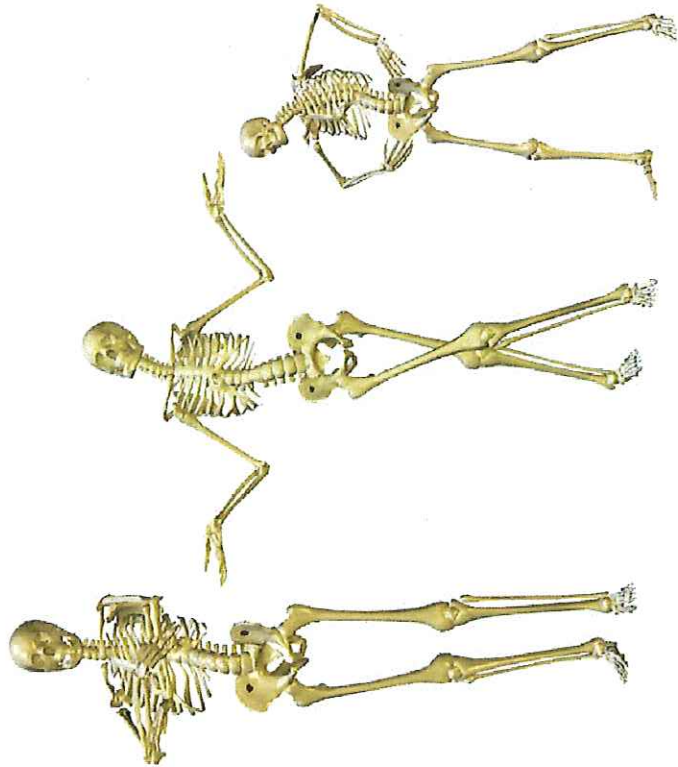
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Written by Lisa Trumbauer

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# The Hard Stuff!

## All About Bones



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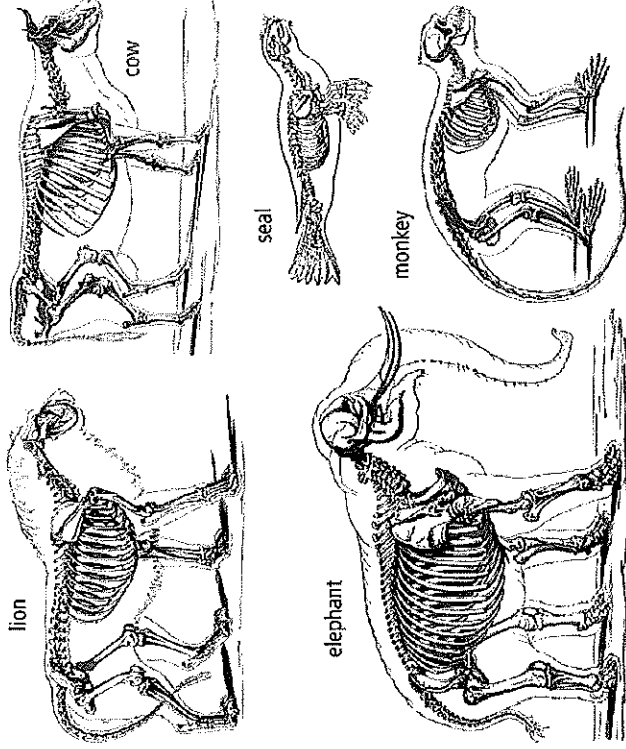
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### Correlation

LEVEL R	
Fountas & Pinnell	N
Reading Recovery	30
DRA	30

## Table of Contents

Body Shapers .....	4
Heads Up .....	6
Put Your Back Into It.....	9
And Now the Limbs.....	11
Don't Get Out of Joint.....	13
Inside Your Bones .....	14
Keeping Bones Healthy .....	15
Glossary .....	17



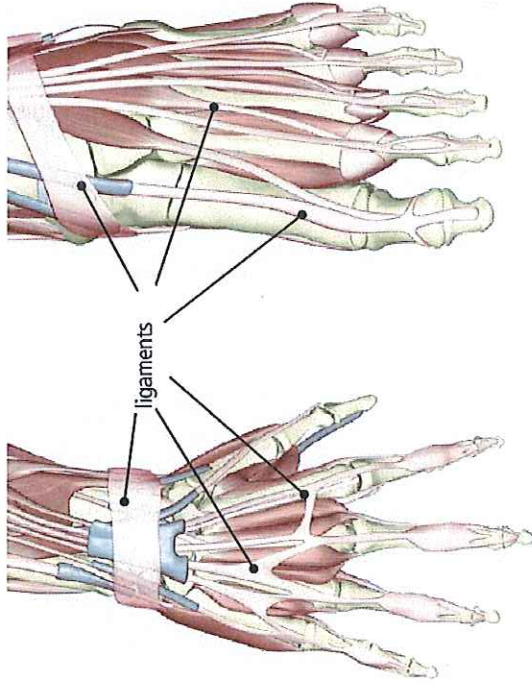
## Body Shapers

Lizards have one. Elephants have one. Even fish have one. You have one, too! What is it? A skeleton!

Skeletons are the bones inside animals' bodies. The skeleton is the frame that muscles and skin wrap around. Skeletons give all vertebrates, including humans, their shape. You can probably name many animals just by looking at their skeletons.

The human skeleton has 206 bones, starting at the top with the skull and ending at the bottom with the toe bones. Many bones have muscles attached to them by **tendons**. These bones help us move. Some bones protect soft organs inside our bodies, such as the heart and brain. And many big bones have special areas in the center that make blood cells. Tissues called **ligaments** connect all the bones together to form the skeleton.

To learn how bones work, let's take a closer look at different areas of the body.



Ligaments hold the hand and foot bones together.



These racers wear helmets to protect their skulls.

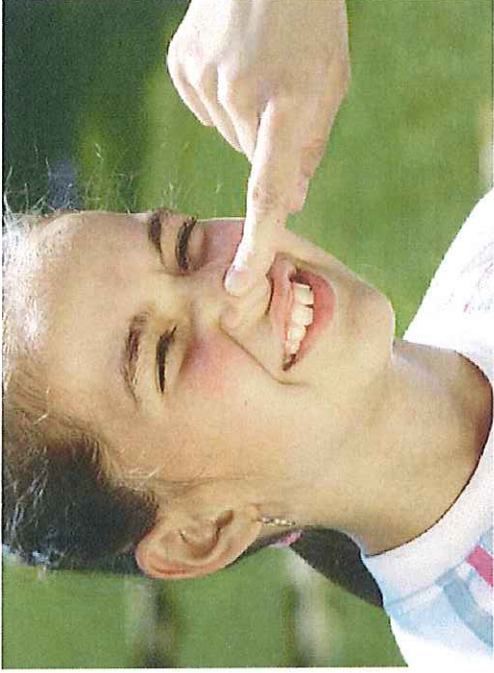
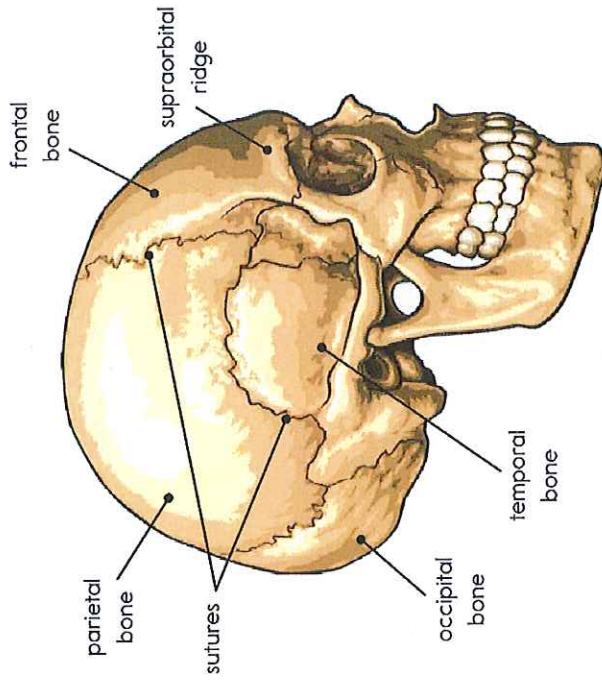
## Heads Up

Press your hand against your forehead—the part of your face above your eyebrows. You can feel your skull, or *cranium*, under the skin. The cranium is one set of bones in your body. It protects your brain, a very important and very soft organ. The cranium is like a crash helmet, but it is not as strong. For that reason, you should wear a helmet for sports such as biking and skating.

If you feel your head, your skull seems to be one piece. In fact, the skull is made up of many bones. The bones join at special joints called **sutures**. Unlike other joints, the sutures cannot move much.

Your skull has twenty-two bones, not counting the six in your ears and one in your throat. Under your cheeks, you can feel your cheekbones. Your jaw is made up of two bones.

Major Skull Bones



Cartilage is softer than bones, but teeth are harder.

If you look at a skeleton, you might see something missing from its face—a nose. The part of your nose that sticks out is not bone. Your nose is made of a tissue called **cartilage** (CAR-tih-ledj). Touch your nose and move it around. Cartilage can bend. Your bones cannot. You also have cartilage at the ends of bones. Cartilage keeps bones from rubbing against each other.

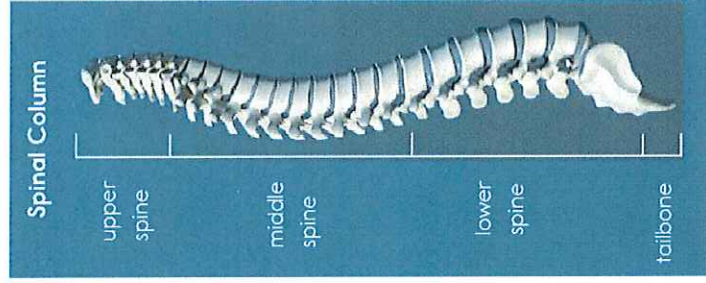
Skeletons also have teeth, but teeth are not bones. Teeth are harder than bones. The outside of a tooth is made of enamel. Enamel is the hardest thing in the body.

### Put Your Back Into It

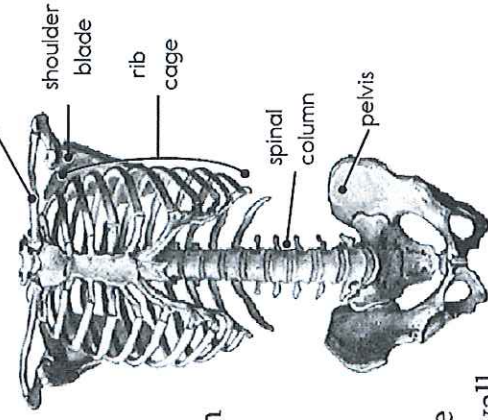
The skull connects to the spinal column, or backbone. You can feel the first few parts of the spinal column along the back of your neck. These bumps form your backbone and continue all the way to your hips. The bones in your back are called vertebrae (VER-teh-bray).

Your spinal column has two jobs. First, it protects the **spinal cord**, which runs through the vertebrae. The spinal cord is the place where your nerves meet to send information to your brain.

The second job of your spinal column is to let you bend, twist, roll, and flip. The backbone is a chain of bones, not one solid bone. It is flexible and can move in many directions.



The skull is not the only set of bones attached to the backbone. The ribs and pelvic bones are attached to it, too.



The ribs protect your lungs and heart. The lungs and heart lie inside the ribs, which form the rib cage. If you bang your chest, your lungs and heart don't get crushed because the ribs form a strong wall around them. Your rib cage has twelve bones on each side.

Near the top of the spinal column are the shoulder blades and the collarbones. These bones make up the shoulders.

Near the bottom of the spinal column, two hip bones make up the pelvis. On each side, a pelvic bone looks like a small bowl. That's because it holds your intestines and other lower-body organs.

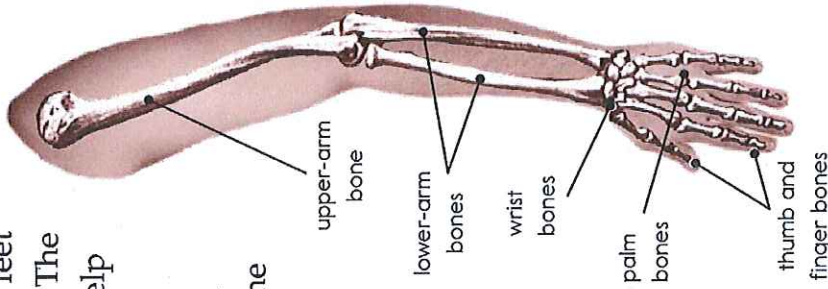
## And Now the Limbs

Your arms and hands let you lift and hold things. Your legs and feet help you to move around. The bones inside your limbs help you to do these actions.

Your arms each contain three bones. One bone is the upper-arm bone, attached at the top to the shoulder. Two bones make up the lower arm, between the elbow and the wrist.

Your wrist and hand together have more bones than any other part of your body—twenty-seven! That's a total of fifty-four bones for both hands.

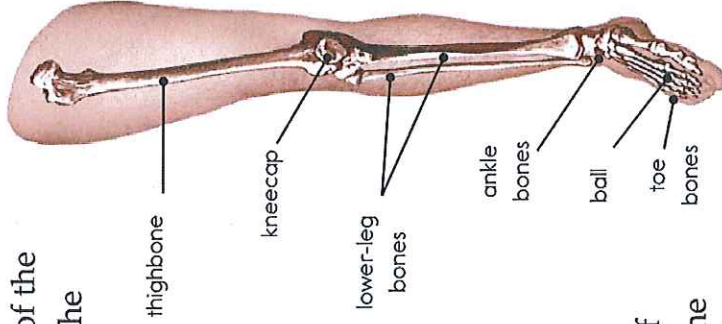
Because wrists and hands have so many bones, they are flexible and precise. If they weren't, we couldn't do things like writing and drawing, playing the piano, and tying shoelaces.



The bones of the legs and feet are like the bones of the arms and hands. The top of the leg is one solid bone, called the thighbone. The bottom of the leg has two bones. Between the upper and lower parts of the leg is one more bone—the kneecap. The kneecap lies over the knee joint. It protects the tendons beneath it that let the leg bend.

Like the hand, the foot contains many bones—twenty-six. That's fifty-two bones for both feet. The ankle and heel of a foot have seven bones. The ball of a foot has five bones. The foot has fourteen toe bones—two for the big toe and three each for the other

toes. Skin and tissue on the bottoms, or soles, of the feet protect the bones when you jump and run.



## Don't Get Out of Joint

Along with 206 bones, the adult human body has over 100 joints. Joints are the places where bones meet. Bones are hard and do not bend. We can bend and twist because bones connect at joints.

Not all joints are the same. The joint where the upper-arm bone connects to the shoulder bone is a **ball-and-socket joint**. The connection between the upper-leg bone and the hip bone is another joint of this type. The top end of the upper-arm bone has a ball shape. This ball fits into a round hole, or socket, in the shoulder.



Your joints allow you to bend and twist into unusual positions.

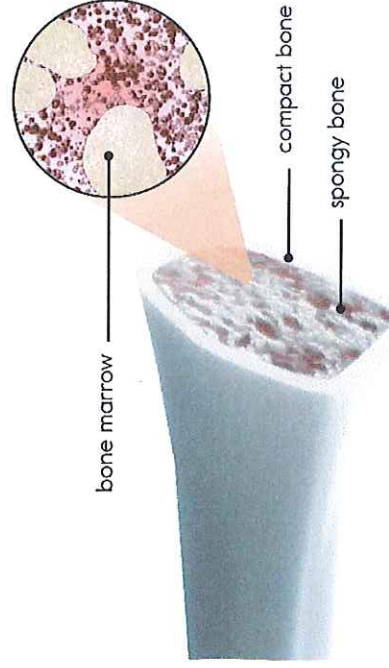
The elbow joint and the knee joint are **hinge joints**. Hinge joints only bend one way. The joints between the vertebrae are **swivel joints**, which tilt and turn. The last type of joint is a suture, like those on the skull. Sutures connect bones but do not move much.

## Inside Your Bones

Bones may feel hard and solid like rocks, but they are not. Bones are alive with millions of bone cells. Bone cells need oxygen and food, just like other cells.

On the outside, a bone is hard and solid. This part is the *compact bone*. Below the compact bone is the *spongy bone*. Spongy bone has holes to keep the bones light so our muscles can lift them.

Inside the spongy bone is **bone marrow**. The body uses bone marrow to make blood cells. About half a pound of bone marrow makes about 50 billion red blood cells every day!





## Keeping Bones Healthy

Even though bones are strong, they can break if they are hit hard enough. Broken bones can be fixed. Healing a broken bone takes a little help from a doctor and a lot of help from bone cells.

For a bone to heal correctly, the bone must be put back the way it was before the break.

Doctors may move broken bones to put them back in place. They set a cast around the body part where the bone was broken.

The cast keeps the body part from moving so the bone can heal. As soon as a bone breaks, bone cells begin repairing it. Holding the broken bone in place with a cast lets the bone cells do their job.

A cast helps hold a broken bone in place so it can heal.



Bones need to stay healthy to remain strong. Exercising regularly is the best way to keep your bones in good working order. Eating a well-balanced diet helps the bone marrow to produce healthy blood cells. **Legumes**

(such as peas or pinto beans), other vegetables, and fruits are good for your bones.

Foods rich in calcium, such as dairy products and fortified soy milk, rice milk, and orange juice, can also help bones to grow.

Bones give your body its shape, and they also give you much more. They allow you to move, sit, stand, and write. You wouldn't be you without your bones!

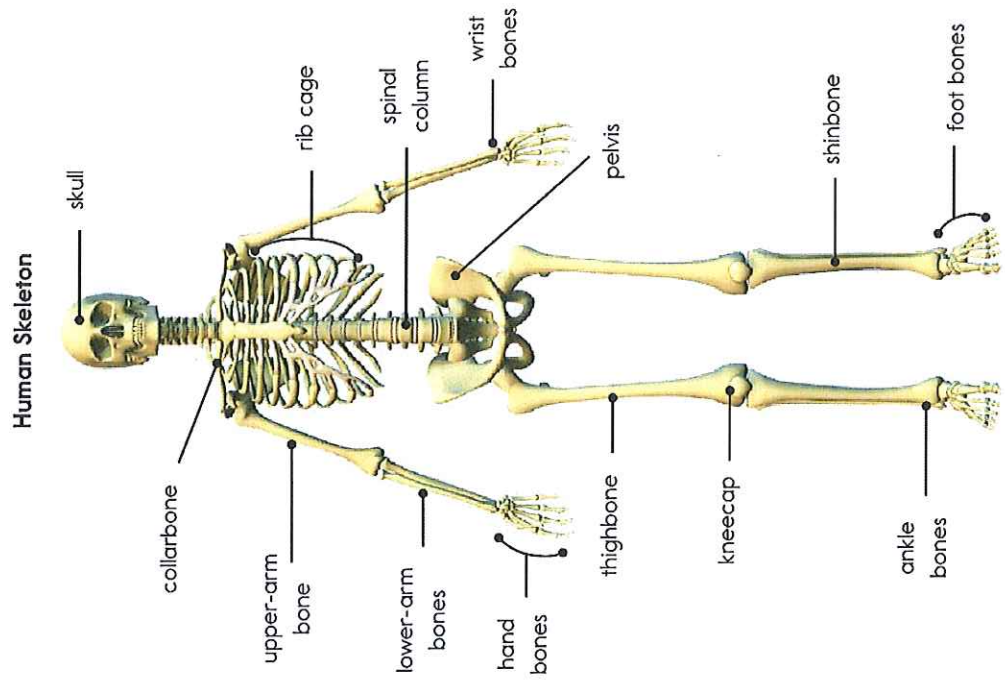


Foot bones are cushioned by the skin and tissue around them so they don't break when you run, jump, and hop.

**Glossary**

- ball-and-socket joint** (*n.*) a joint that fits together as a ball fits into a glove (p. 13)
- bone marrow** (*n.*) spongy material in the center of bones that makes blood cells (p. 14)
- cartilage** (*n.*) an elastic tissue found in humans and other vertebrates (p. 8)
- hinge joints** (*n.*) joints that open like a door (p. 13)
- legumes** (*n.*) plants with seed pods, such as beans, lentils, and peas (p. 16)
- ligaments** (*n.*) tissues that connect one bone to another bone (p. 5)
- precise** (*adj.*) exact in movement or operation (p. 11)
- spinal cord** (*n.*) a collection of nerves that are protected by vertebrae (p. 9)
- sutures** (*n.*) joints or seams between skull bones (p. 7)
- swivel joints** (*n.*) joints that can tilt or turn (p. 13)

- tendons** (*n.*) tough tissues that attach muscles to bones (p. 5)
- vertebrates** (*n.*) animals with backbones (p. 4)



Name \_\_\_\_\_

Date \_\_\_\_\_

Instructions: Read each question carefully and choose the best answer.

1. What is this book mostly about?
  - (A) There are many kinds of bones in the human body.
  - (B) Different animals have different bones.
  - (C) Bones change their shapes over time.
  - (D) There are many ways to fix broken bones.
2. What might happen if you had no skull bones?
  - (A) Your heart might be injured.
  - (B) You might have trouble moving.
  - (C) You might not be able to stand up straight.
  - (D) Your brain might get damaged.
3. What are ligaments?
  - (A) joints that can tilt or turn
  - (B) tissues that attach muscles to bones
  - (C) tissues that connect one bone to another bone
  - (D) a tough rubbery substance

4. How are teeth and bones different?
  - (A) Teeth are harder than bones.
  - (B) Teeth have more joints than bones.
  - (C) Teeth do not ever break.
  - (D) Teeth grow faster than bones.
5. If you break your rib cage, what could be hurt?
  - (A) your legs
  - (B) your lungs
  - (C) your brain
  - (D) your wrist
6. The section titled "And Now the Limbs" is mostly about \_\_\_\_\_.
  - (A) arms and legs
  - (B) toes and feet
  - (C) wrists and shoulders
  - (D) backbones

Quick Check continued on following page

- 9. What is cartilage?
  - (A) joints that hinge
  - (B) material that protects the spinal cord
  - (C) a special kind of bone
  - (D) rubbery material at the end of bones

- 8. What is a fact from the section titled "Inside Your Bones"?
  - (A) Bones contain spongy material inside them.
  - (B) Bones are harder on the inside than on the outside.
  - (C) Bones cannot heal if broken.
  - (D) Tendons attach to bones.

- 7. The hip and shoulder joints are both \_\_\_\_\_.
  - (A) hinge joints
  - (B) ball-and-socket joints
  - (C) weak joints
  - (D) all of the above

- 10. What creates new blood cells?
  - (A) legumes
  - (B) joints
  - (C) bone marrow
  - (D) spinal cord
- 11. Extended Response: Why are bones important to humans?
 

How would things be different if each of your fingers only contained one bone?
- 12. Extended Response: How

Name \_\_\_\_\_ Date \_\_\_\_\_

Quick Check (continued)

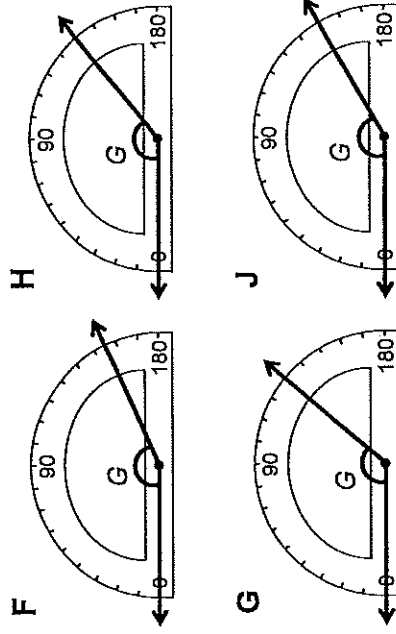
The Hard Stuff! All About Bones

1 Mr. Carter will pack his entire collection of model airplanes into boxes. He has 148 airplanes and he will pack no more than 8 airplanes in a box. What is the minimum number of boxes he will need?

- A 15 boxes
- B 18 boxes
- C 19 boxes
- D 22 boxes

4H

4 Gino used a protractor to measure four angles. Which diagram shows angle G equal to 140 degrees?



7C

5 Lanelle will use 10 of the beads shown below to make a necklace.



Which fraction is equivalent to the fraction of beads Lanelle will use to make the necklace?

- A  $\frac{2}{3}$
- B  $\frac{1}{2}$
- C  $\frac{3}{5}$
- D  $\frac{1}{3}$

2 Look at the input-output table.

Input, Position	Numerical Expression	Output, Value
1	$12 \times 1$	12
2	$12 \times 2$	24
3	$12 \times 3$	36

What would be the value of the number in the nineteenth position?

- F 108
- G 178
- H 228
- J 319

5B

3 A pottery company sold 13,658 bowls in March, 17,249 bowls in April, and 24,487 bowls in May. Which expression is closest to the total number of bowls the company sold in March, April, and May?

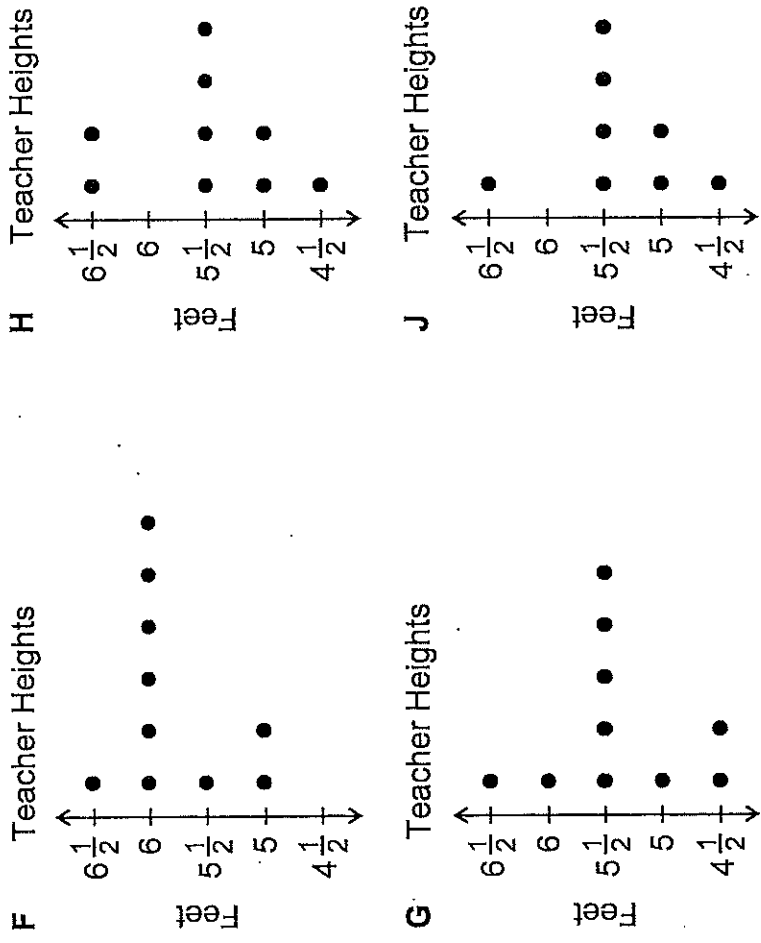
- A  $10,000 + 17,000 + 20,000$
- B  $14,000 + 17,000 + 24,000$
- C  $14,000 + 18,000 + 25,000$
- D  $13,000 + 17,000 + 24,000$

4G

6 The list below shows the heights of 10 teachers rounded to the nearest half foot.

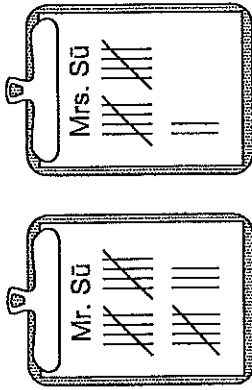
- Ortiz:  $5 \frac{1}{2}$
- Green: 5
- Wáng:  $5 \frac{1}{2}$
- Jones: 5
- Rahal:  $5 \frac{1}{2}$
- Ramos:  $6 \frac{1}{2}$
- Martin:  $5 \frac{1}{2}$
- Almasi:  $5 \frac{1}{2}$
- Perea:  $5 \frac{1}{2}$
- Lewis:  $4 \frac{1}{2}$

Which dot plot correctly represents the heights of these teachers?



9A

1 Mr. and Mrs. Sū write a tally mark on a clipboard each time they jog 15 miles on a treadmill.



How many miles have they jogged on the treadmill combined?

- A 430 B 450 C 475 D 490

4D

5 Kara wrote a series of numerical expressions to generate a number pattern.

$$50 - 1, 50 - 2, 50 - 3 \dots$$

Which table represents inputs and outputs that follow the same rule?

**A**

Input	Output
8	40
21	27
32	16

**B**

Input	Output
9	46
23	32
34	21

**C**

Input	Output
11	39
24	26
35	15

**D**

Input	Output
12	32
27	17
38	6

5B

2 Dylan began reading a book at 3:15 P.M. He stopped at 5:35 P.M. How many minutes elapsed between these two times?

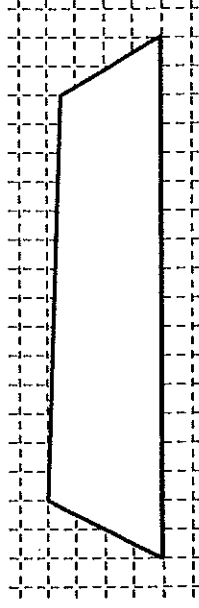
0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

8C

4 Which pair of fractions are equivalent?

- F  $\frac{3}{4}$  and  $\frac{6}{12}$  G  $\frac{3}{4}$  and  $\frac{9}{16}$

3 What is the name of the figure shown here?



- A Rectangle C Parallelogram  
B Trapezoid D Not here

6D

- H  $\frac{3}{4}$  and  $\frac{9}{12}$  J  $\frac{3}{4}$  and  $\frac{6}{9}$

3C

7 Before a soccer game, Alex drank 0.5 liters of water. Jada drank 0.45 liters, Anna drank 0.6 liters, and Neil drank 0.65 liters. Which table represents this information?

**A**

Alex	Jada	Anna	Neil
$\frac{5}{10}$	$4\frac{5}{10}$	$\frac{6}{10}$	$6\frac{5}{10}$

**B**

Alex	Jada	Anna	Neil
$\frac{5}{10}$	$4\frac{5}{100}$	$\frac{4}{10}$	$6\frac{5}{100}$

**C**

Alex	Jada	Anna	Neil
$\frac{5}{10}$	$\frac{45}{100}$	$\frac{6}{10}$	$\frac{65}{100}$

**D**

Alex	Jada	Anna	Neil
$5\frac{1}{10}$	$\frac{45}{100}$	$6\frac{1}{10}$	$\frac{65}{100}$

9B

6 The table shows the number of laps that three students ran around the track at recess last week.

Laps Around the Track

Student	Day of the Week					
	M	T	W	T	F	F
Isaac	9	13	9	12	10	
Montel	12	7	10	9	11	
Ling	8	12	11	9	8	

On which day of the week did the three students run the greatest number of laps combined?

- F Tuesday H Monday  
G Friday J Thursday

1 To earn money, Mr. Hilton drives a delivery truck. His monthly operating expenses are shown below.

Monthly Expenses	
Toll road fees.....	\$65 to \$125
Truck payment.....	\$495
Phone bill.....	\$79 to \$150
Truck fuel.....	\$340 to \$480

Which expense appears to be a fixed expense?

- A Toll road fees    C Phone bill  
 B Truck payment    D Truck fuel

10A

4 Which decimal and fraction does this model represent?



- F 8.6 and  $8\frac{6}{10}$     H 7.04 and  $7\frac{4}{10}$   
 G 7.04 and  $7\frac{4}{100}$     J 7.4 and  $7\frac{4}{10}$

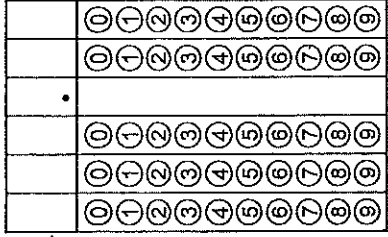
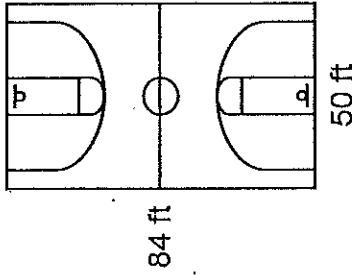
26

5 If Sarah adds 0.25 kilograms of cans to the recycling bin, the total mass of the cans in the bin will be 3.5 kilograms. What is the mass of the cans in the bin right now?

- A 3.25 kilograms  
 B 3.55 kilograms  
 C 3.75 kilograms  
 D 3.95 kilograms

4A

2 A model of a basketball court is shown below. What is the perimeter of the basketball court in feet?



5D

6 Earnest has  $\frac{8}{14}$  ounce of gold dust and  $\frac{11}{24}$  ounce of gold nuggets. He estimates that he has close to 1 ounce of gold in all.

$$\frac{8}{14} + \frac{11}{24} \text{ is about } 1$$

Is Earnest's estimate accurate?

- F Yes, because  $\frac{8}{14}$  is close to 0 and  $\frac{11}{24}$  is close to 1.  
 G Yes, because  $\frac{8}{14}$  is close to  $\frac{1}{2}$  and  $\frac{11}{24}$  is close to  $\frac{1}{2}$ .  
 H No, because  $\frac{8}{14}$  is close to 0 and  $\frac{11}{24}$  is close to 0.  
 J No, because  $\frac{8}{14}$  is close to 1 and  $\frac{11}{24}$  is close to 1.

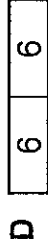
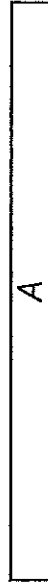
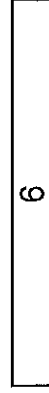
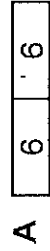
3F

3 Mr. Rivera dieted for two weeks. He lost three eighths of a pound during the first week and one fourth of a pound during the second week. Which compares these fractions correctly?

- A  $\frac{1}{4} > \frac{3}{4}$   
 B  $\frac{3}{8} = \frac{1}{4}$   
 C  $\frac{3}{4} > \frac{1}{8}$   
 D  $\frac{3}{8} > \frac{1}{4}$

3D

7 Ruth and Kelly each have 6 marbles. Aaron has twice as many marbles as Ruth and Kelly combined. Which diagram best represents this situation where A is the number of marbles Aaron has?



5A