Firstly, when we talk about thorax, we should begin with the thorax wall which means not only bones that construct the thorax but also the muscles which connect these bones together.
So **Thoracic wall = bones + muscles.**

Beginning with the bones (the bony thorax):
- Anteriorly: We'll find the **Sternum** (عظمہ القسم).
- From both sides of the thoracic wall: **The ribs** (12 in each side, total= 24).
- Posteriorly: **Vertebral Column** (encloses the thoracic wall posteriorly).

Let's get a closer look to each of these parts..
1- Sternum:
Composed of 3 parts:

a- Manubrium Sterni: (superiorly) its shape is quadrangular.
b- Body of the Sternum: the major and biggest part in the sternum
c- Xiphoid process: (inferiorly) the lower tapering small part of the sternum.

A- Manubrium Sterni: quadrangular (so it has 4 borders):

1- Upper border:
contains a notch (which is called Sternal notch) .. It's an important landmark because behind it there are vessels and the trachea (القصبة الهوائية).

Clinical application:
When someone can't breath (obstructive airway), Sternal notch is a very important landmark for first aid, We open the trachea by locating it with the help of this notch.

2- Both lateral sides:
a Clavicular notch that receives the clavicle.

Note:
The joint between the clavicle and the sternum is the Sternoclavicular joint which is a synovial joint. More specifically, a double-plane joint.

3- Lower border:
The place of meeting between Manubrium and the Body.. Here, the Manubrium (ذراع الرحمنة), whereas the body of sternum is standing vertically so there's an angle between them (which is called the sternal angle) ➔ very important landmark.

B- The body of the sternum: receives the ribs from both sides.
2- The Ribs:
There are two types of classification of the ribs:

A- According to their attachment to the Sternum: 3 kinds!

- Every rib starts from the vertebral column and it rotates (forming the thoracic wall) until it reaches the sternum. But before a little from reaching the sternum, the bony rib finishes (the rib as a bone), so another part of it continues to reach the sternum, which is the costal cartilage note: costal = rib.

So there are 3 kinds of ribs according to their attachment to the sternum:

1- True ribs: (from 1st rib to the 7th): They all reach the sternum and their costal cartilage gets attached to the sternum directly.

2- False ribs: (from 8th rib to the 10th): They don't reach the sternum, but each costal-cartilage of everyone one of them gets attached to the costal cartilage of the rib above it.
3- **Floating ribs:** (11\(^{th}\) and 12\(^{th}\) ribs): Their costal-cartilage is very short, it neither reaches the sternum to get attached to it nor gets attached to the one above, so it remains floating in the body.

B- **According to the features (shape of the ribs):**

- **Important note:**
  to put the bone in the anatomical position (and therefore to know the general features of the bone), we have to answer 3 questions: where's the superior and the inferior, where's the anterior and the posterior, where's the medial and lateral.
  So to study the general features of the ribs, we have to answer these 3 questions.

- **Note:**
  Ribs are long bones, but they're horizontal in general (so we can't divide the bone into shaft, proximal and distal parts). We divide the bone of the rib into: Anterior end, Posterior end and Shaft of the bone.

1- **Typical ribs:** (3\(^{rd}\) rib to the 9\(^{th}\):)

Let's answer the three questions to study the general features of the ribs and divide them according to their features!

**First question: which is anterior and which is posterior?**

- **Anterior end:** has just a small concavity to attach to the costal cartilage (which will reach the sternum or attach to the costal cartilage above).

- **Posterior end:** 3 features:
  - Head: A horizontal ridge divides the head into 2 hemi-facets (these facets will be involved in articulation with the vertebral column).
  - Neck: A small constriction.
  - Tubercle: (bony process).

**Second question: Which is medial and which is lateral?**
Shaft of the rib: it's located longitudinally so it has 2 surfaces:
- Outer surface: convex.
- Inner surface: concave.

Third question: which is superior and which is inferior?

This rib has two borders:
- Upper border: blunt (not sharp)
- Lower border: sharp ( samt 6 حثلازوف عامل زي حد السكتة بالزربط). Also, below the rib, there's a groove called Sub-costal groove. (that's why the lower border is sharp).

2- Atypical ribs: (1\textsuperscript{st}, 2\textsuperscript{nd}, 10\textsuperscript{th}, 11\textsuperscript{th}, 12\textsuperscript{th})

- 10\textsuperscript{th} rib isn't important for now, So we'll talk about 1\textsuperscript{st}, 2\textsuperscript{nd}, 11\textsuperscript{th} and 12\textsuperscript{th} ribs.
- The most important rib of them is the 1\textsuperscript{st}.

Let's answer the three questions and discuss the general features of this group of ribs to know the difference from the typical ribs:

- The 1\textsuperscript{st} rib:

  First question: (anterior and posterior):

  - Anteriorly: same concavity as the typical ribs.
  - Posteriorly: same 3 features of the typical ribs.

  Second question (medial and lateral):


Here's the difference number 1!
The rib here has 2 borders "medially and laterally" (not two surfaces as the typical ribs!)
- Outer border: convex.
- Inner border: concave.

Third question (superior and inferior):

Here's the difference number 2!!
In the Atypical ribs, the shaft is flattened so it has two surfaces superiorly and inferiorly (not two borders as the typical ribs!)
- Superior surface: rough! (because of the tubercle on it, to whom the Scalenus anterior muscle will be attached, and thus it'll be named "The Scalene tubercle")
  * There are two grooves on the 1st rib related to the scalene tubercle:
    1. **Anterior groove:** for the subclavian vein.
    2. **Posterior groove:** for the subclavian artery.
- Inferior surface: smooth! (to protect the contents of the thoracic cage specially the **plura** which will be injured during respiration if the surface isn't smooth).

The 2nd rib:
The same anterior and posterior ends of the 1st rib. But It's like a transitional rib between the first rib and the typical ribs, so it's oblique. And since it's oblique, it doesn't have neither an inner and outer surfaces nor upper and lower surfaces.

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**Note:**
it's shown more clearly in the lab, not the pictures.

**Keep in mind:**
1st rib: horizontal
2nd rib: oblique
3rd - 9th ribs: longitudinal

The 11th and 12th ribs:

First question:
- **Anteriorly:** no concavity! But a tapering end! Because their costal cartilages are very short so they don't need a concavity to attach to their short costal cartilage.
- **Posteriorly:** head and neck … But NO tubercle!

Second and Third questions:
- Their shaft is just like the 1st rib except that it doesn't has a sub-costal groove on their surface!
• Now let’s see how the ribs are attached to the Sternum.

- The 1st rib is attached to the Manubrium on the both lateral sides of it.
- The 2nd rib is attached to the point of attachment between Manubrium and body of Sternum.
- 3rd, 4th, 5th and 6th ribs are attached to the body of Sternum.
- 7th rib is attached to the attachment point between Body and Xiphoid process.

**Clinical application:**

When you want to feel the heart beat of a patient, the apex of the heart (to feel the heart beat on it) is located in the 5th intercostal space.

But how can we know where the 5th intercostal space is located exactly?!

Simply, we begin by feeling the Manubrium of the Sternum and then getting downward until reaching the Sternal angle, and here we know that the 2nd rib is attached to it. So we continue counting from the 2nd rib downward until we reach the 5th rib, and below it we find the 5th intercostal space! Thus, we can feel the heart beat a little away from the median line.

*Intercostal space = space between ribs.*

3- **Vertebral column**

![Vertebral Column Diagram](image)

- Composed of 33 vertebrae:
  1- Cervical vertebrae: 7.
  2- Thoracic vertebrae 12. (a part of the thoracic cage, to whom the ribs are attached).
  3- Lumbar vertebrae: 5.
  4- Sacral vertebrae: 5 (they were five separate vertebrae through the development, but they are fused then to compose the sacrum).
  5- Coccygeal vertebrae: 3-5 (We take the average 4).

Actually, the Coccyx region is the tail, but we humans don't have one. Because at the beginning of the development, they were from 8-10 vertebrae! But they experience gradual disappearance till they're reduced to 3-5 vertebrae.

**Total = 33**
Note:
All the vertebrae of vertebral column share the same general features, but the segments of every region changes specific changes to adapt to their function. (eg. The thoracic segments change to be able to attach to the ribs of the thoracic cage).

An information you should know:
(even if you're not going to be asked about in the exam as Dr said)
At very early time when we are born, the vertebral column has a C-shape! That is directed anteriorly. After two months from the birth, the baby begins to raise his/her head, so the cervical region now has a convexity anteriorly. At the end of the first two years, the baby begins to walk! So the upper part of the body becomes like a weight on the lumbar vertebrae, so it becomes anteriorly convex. Some regions stay anteriorly concave as they are (Primary curves); such as: the thoracic and sacrum regions. Whereas secondary curvatures contain the cervical and lumbar regions.

- General features of the vertebrae (exist in all 33 vertebrae):
  - Every vertebra is composed of Body that's directed anteriorly.
  - There's an arch which is attached to the vertebra posteriorly and directed posteriorly. It's called the Vertebral Arch.
  - The vertebral arch surrounds a foramen which is called the vertebral foramen.
  - All the vertebral foramens together form The vertebral canal in which the spinal cord will pass.
The vertebral arch consists of:

1. 2 Pedicles (attached to the posterior aspect of the body, attached on both sides).
2. 2 Laminas (حليتين) : fused together posteriorly.

>>>The union of pedicles + lamina = vertebral arch.

The vertebral arch gives 7 processes.

1. 2 superior articular processes. (for articulation with the vertebra above).
2. 2 inferior articular processes. (for articulation with the vertebra below).
3. 2 transverse (horizontal processes).
4. Spine (most important): the production of the union of two laminas. It's the only part of the vertebrae that we can feel.

Total = 7

Note:

- Every pedicle has two notches.. one above, and one below. The notch from above units with the vertebra above it and the notch below units with the vertebra below to form the Intervertebral foramen (in which the spinal cord passes).

Note:

- Every nerve from the spinal cord emerges from the Intervertebral foramen according to its number between the-same-number vertebra and the one below (eg. Thoracic nerve number 5 will pass through the intervertebral foramen between 5th thoracic vertebra and 6th thoracic vertebra ... etc).
\[ \text{BUT:} \]
THE FORMER RULE DOESN'T APPLY FOR THE CERVICAL REGION.. SO IT'S AN EXCEPTION!! —— > here the cervical nerve emerges from the intervertebral column between the same-number vertebra and the one above. (eg. Cervical nerve number 3 passes through the intervertebral foramen between 2\textsuperscript{nd} cervical vertebra and 3\textsuperscript{rd} cervical vertebra).

\[ \text{Note:} \]
There are 7 cervical vertebrae but 8 cervical nerves (8\textsuperscript{th} cervical nerve passes through the Intervertebral foramen between 7\textsuperscript{th} cervical vertebra and 1\textsuperscript{st} thoracic vertebra).

Thank you 😊
your colleague: Majd Sleiti.
3-4-2012

"Success is a matter of chance.. Just ask any failure"

And always remember my dear friend that ..

“Chance favours only the prepared minds”.

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