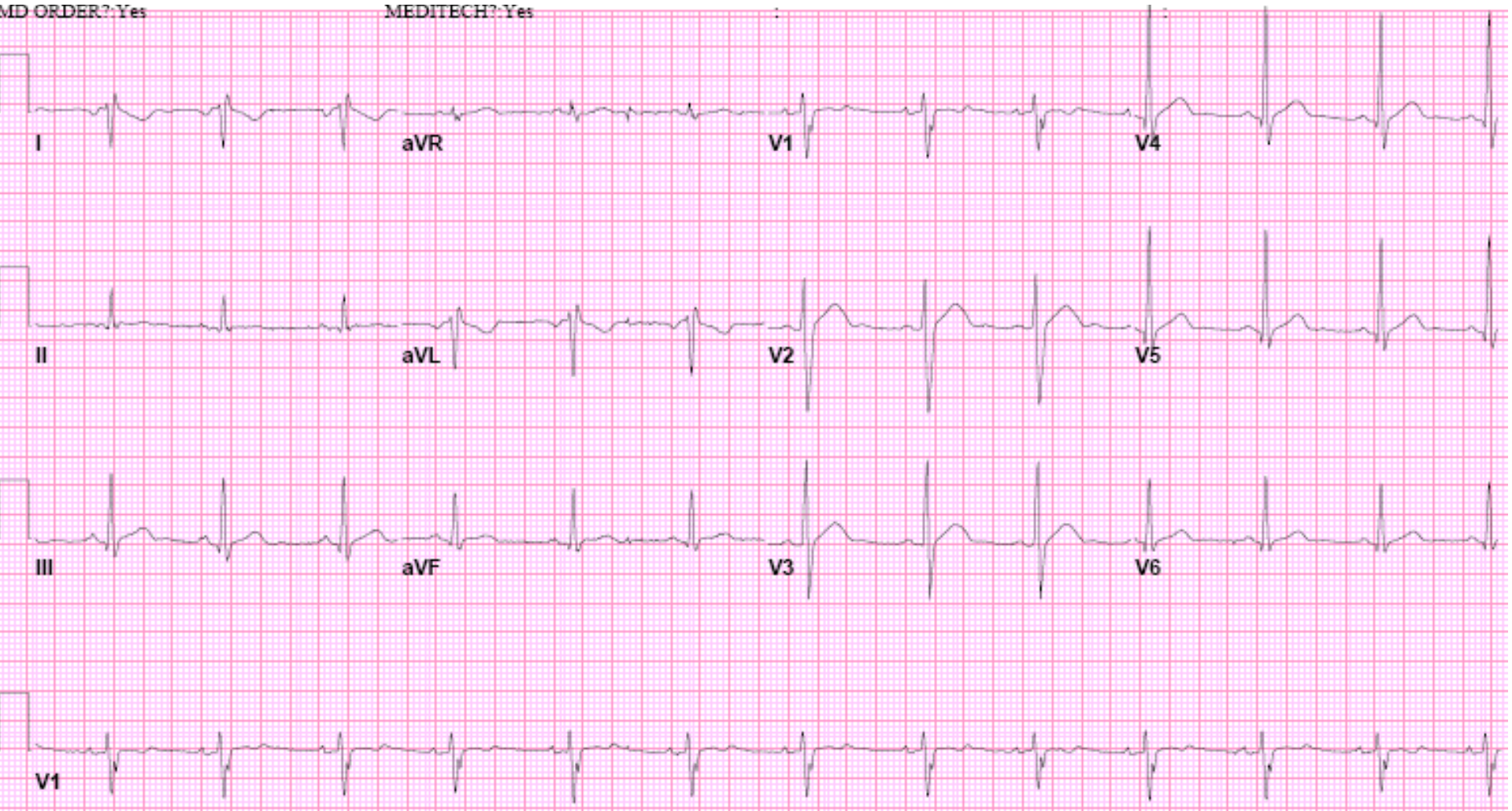
This is an ECG obtained in a 15 year old boy (unknown chief complaint). There are a few ways one might interpret this ECG, but one interpretation is superior to the others.

1) Rate? Is there something unusual about the rhythm? How about the QRS axis? (1 pt)

2) What is the correct reading of this ECG? (1 point)

3) How do you know your answer to question 2 is correct? (2 points)



The answers to last weeks ECG are:

1) **Is there something unusual about the rhythm? How about the QRS axis? (1 point)**
   The rhythm appears to originate from the left atrium, (that is, the P wave is directed from the patient's left toward the patient's right) since the P wave axis is DOWN in lead I! Furthermore, the QRS axis is directed toward the right as well (QRS mostly downward in lead I). When both the P wave and QRS axis are abnormal, this should raise suspicion of a technical error on the ECG.

2) What is the correct reading of this ECG? (1 point): Limb lead reversal. Leads aVR and aVL have been switched.

3) How do you know your answer to question 2 is correct? (2 points): The lead I tracing doesn't look anything like the tracing in lead V6.

Detailed explanation: Ok, ECG basics--the P wave represents atrial depolarization, and this electrical wave propagates from top right (where the SA node "lives" near the entrance of the superior vena cava), to bottom left. Therefore, the P wave should be upright in lead I (the electrical signal is going toward lead I), and upright in lead aVF (the electrical signal is also going toward lead aVF. The QRS complex is formed by the electrical signal that propagates along the His-Purkinje system. This signal also generally flows from top right to bottom left, however newborn infants or people with RV hypertrophy will have a larger electrical signal from the right ventricle, which may "swing" the axis over towards the right. See the following link for a diagram of the directionality of leads in an ECG:
http://www.mdconsult.com/das/book/body/194622983-2/0/1755/I4-u1.0-B978-0-323-05303-7..50009-X--f8.fig?tocnode=55716937

Note that in the ECG below, the P wave is negative in lead I. The QRS is also negative. This means that 1) the patient has situs inversus in which case everything would be a left/right mirror image, 2) the patient has a left atrial rhythm (so the P wave would propagate from left-to-right, away from lead I) and a right axis deviation/RVH (swinging the QRS axis toward the right). Neither of these seems likely. A third possibility is limb lead reversal, which is the most common reason for an unusual P wave axis. But how can we be sure this is the right answer?

Have a look at lead V6. Notice that it looks totally different than lead I. In fact, it looks like a near mirror-image of lead I in terms of polarity! Lead I sits directly to the patient's left in the frontal plane (see link above). We use lead V6 mostly for comparing signals in the horizontal plane, but it also sits directly to the patient's left. Lead I and lead V6 should look pretty much identical in a standard ECG. When they don't, think about limb-lead reversal.