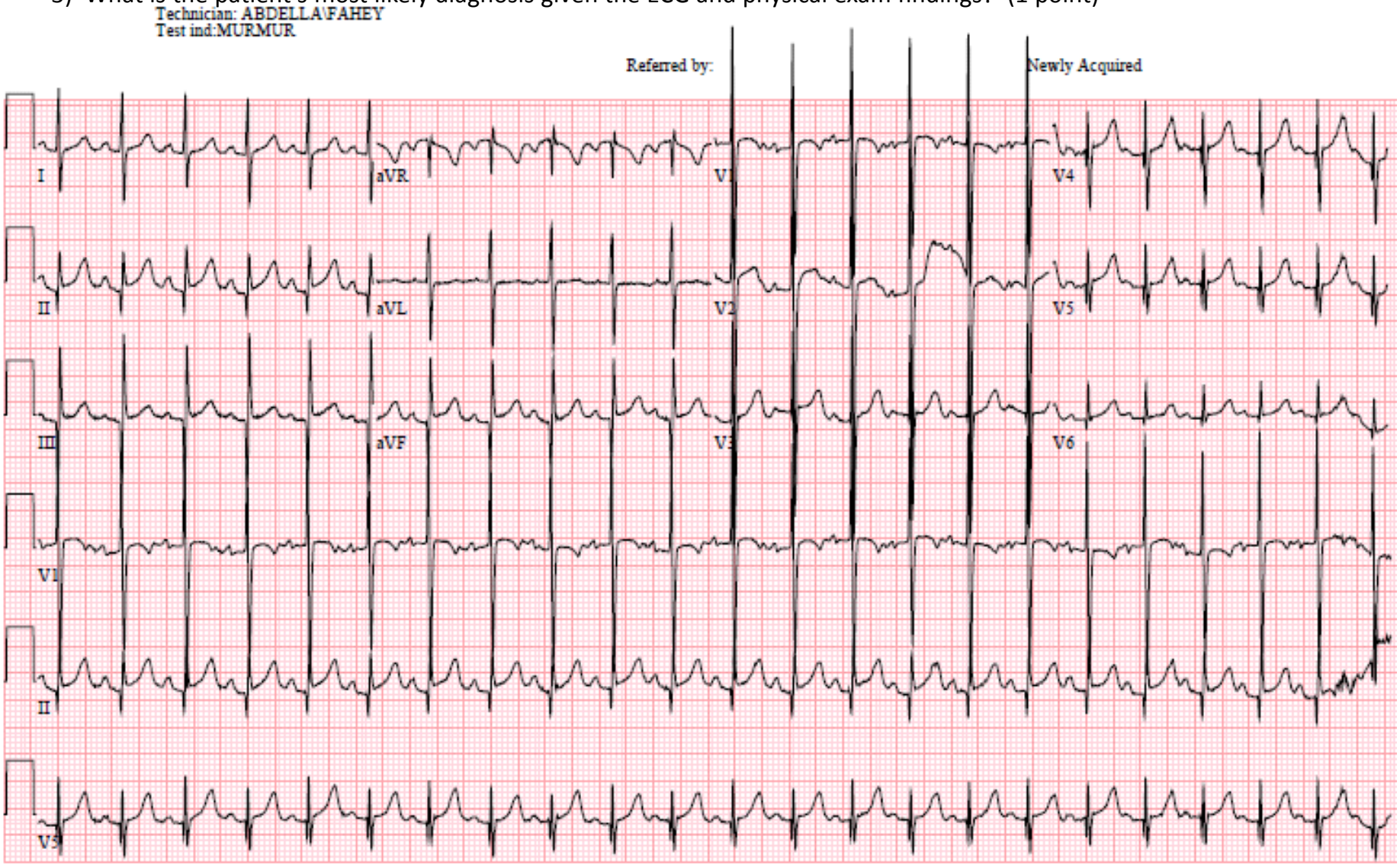
This is an ECG from an 8 month old girl seen in cardiology clinic. There are clearly voltage criteria present for both LVH and RVH when one looks at lead V1. She has a continuous murmur on her exam that radiates to the axillae and does not change with position.

1) What is the rate and rhythm? (1 point) BONUS: what is the QRS axis? (1point)
2) There is another finding (besides voltages in V1) on the ECG consistent with RVH. What is it? (0.5 point)
3) There is another finding on the ECG (besides voltages in V1) consistent with LVH. What is it? (0.5 point)
3) What is the patient's most likely diagnosis given the ECG and physical exam findings? (1 point)



1) What is the rate, rhythm, and axis?

The rate is about 138bpm. The rhythm is normal sinus rhythm (note normal P wave axis, P with every QRS, QRS for every P).

BONUS: The QRS axis is indeterminate. Note that the QRS is nearly equiphasic (as much up as it is down) in all limb and bipolar leads. This means the QRS axis must be more-or-less perpendicular to ALL these leads. How is that possible? The QRS axis must be oriented nearly anterior-posterior! We call this "indeterminate" as we usually define QRS axis in a frontal/coronal plane.

2) There is another finding on the ECG consistent with RVH. What is it? (0.5 point)

Look at the T waves in lead V1. They are biphasic (part up, part down). T waves in the right sided precordial leads, particularly lead V1, should be fully inverted until at least 10 years of age or so. If they are flattened, biphasic, or upright in lead V1 before the age of 10 years, think RVH. This is not an absolute rule, but should definitely make you suspicious of RVH.

3) There is another finding on the ECG consistent with LVH. What is it? (0.5 point)

Note the deep Q waves in the inferior leads (leads II, III, and aVF). Particularly in leads III and aVF they are huge!!! Deep Q waves (greater than or equal to 5 little boxes) in the inferior leads or lateral precordial leads (V5, V6) are suggestive of LVH.

4) What is the patient's most likely diagnosis given the ECG and physical exam findings? (1 point)

There are only a few possibilities for continuous murmurs: venous hum, patent ductus arteriosus (PDA), or some sort of vascular malformation (e.g. arterovenous fistula, coronary-cameral fistula, etc). A venous hum is an innocent continuous murmur heard near the clavicles. This sound will disappear in the supine position or if the jugular vein is occluded on the side you hear the murmur. PDA murmurs typically radiate to the axillae (PDA allows blood to go from the systemic to pulmonary circulation--down the path of least resistance), and should not change much with position. A PDA is most likely here, as AVM's and coronary-cameral fistulae are not nearly as common.