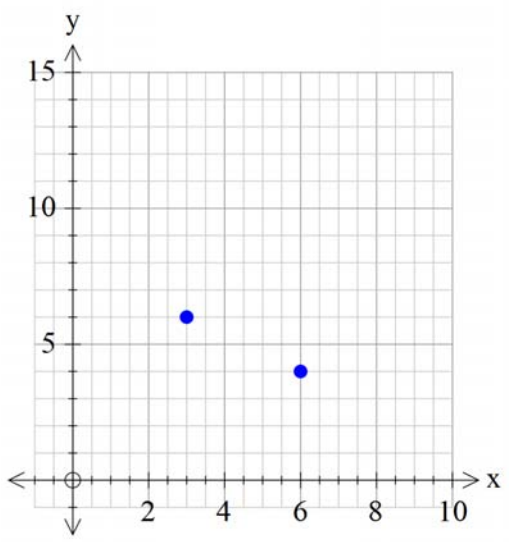
2018 SAC 1 - PREP 1

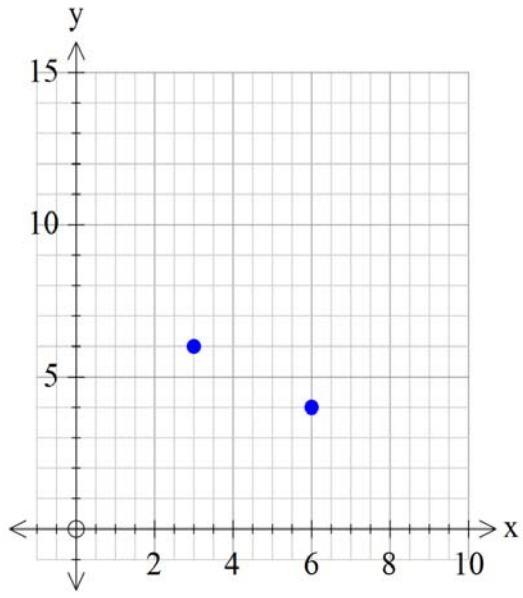
John is a robotics expert. He wishes to create a robot that will follow a particular path. His success will be measured by how close the robot can follow certain criteria. If the robot veers too far from a chosen path it will be deemed unsuccessful. The success of the project will depend on the ability of the robot to determine a suitable curve.

John marks out the experiment area as seen below. His robot will need to pass over the points identified.

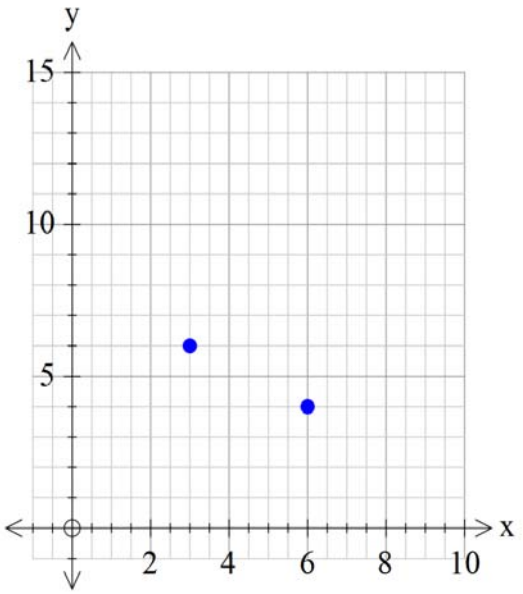


a) Determine an equation of a parabola that passes through these two points and one other point chosen by you. Sketch the parabola on the axes above.

b) Determine an equation of a parabola that passes through these two points where the turning point occurs at (3,6) and the curve passes through (6,4). Sketch on the axes below.



c) Determine an equation of a parabola that passes through these two points and the point (5,2). Sketch.



d) John decides to make the robot's path more challenging by following a cubic rule. He knows that he will need to specify four points for the robot to calculate the path. Explain.

e) Determine the rule for a cubic function ($y = ax^3 + bx^2 + cx + d$ that passes through (3,6), (6,4) and (5,2) where $a = 1$. Sketch the result on the axes above in **part c)**.

f) Compare and contrast the quadratic found in **part c)** and the cubic found in **part d)**

g) Modify the rule for the cubic model so that it more closely matches the quadratic function found in **part c)**. (NOTE: it must pass through the three points but *a* does not equal one).