

2021 MCAS Sample Student Work and Scoring Guide

Grade 10 Mathematics

Question 6: Constructed-Response

Reporting Category: Geometry

Standards: [GEO.G-GPE.B.5](#), [MI.G-GPE.B.5](#) - Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

Item Description: Write equations of lines that are parallel and perpendicular to given lines passing through given points.

Calculator: Not allowed

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Scoring Guide

Select a score point in the table below to view the sample student response.

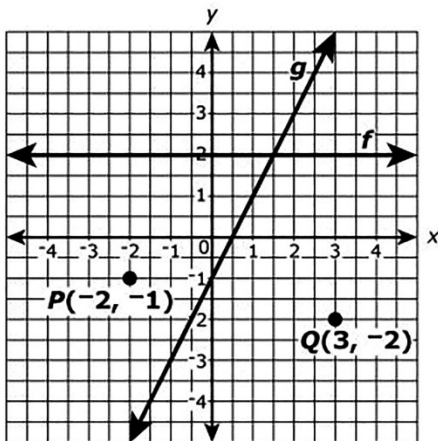
Score*	Description
4A	The student response demonstrates an exemplary understanding of the Geometry concepts involved in proving the slope criteria for parallel and perpendicular lines and using them to solve geometric problems. The student writes equations of lines that are parallel and perpendicular to given lines passing through given points.
4B	
3	The student response demonstrates a good understanding of the Geometry concepts involved in proving the slope criteria for parallel and perpendicular lines and using them to solve geometric problems. Although there is significant evidence that the student was able to recognize and apply the concepts involved, some aspect of the response is flawed. As a result, the response merits 3 points.
2	The student response demonstrates a fair understanding of the Geometry concepts involved in proving the slope criteria for parallel and perpendicular lines and using them to solve geometric problems. While some aspects of the task are completed correctly, others are not. The mixed evidence provided by the student merits 2 points.
1	The student response demonstrates a minimal understanding of the Geometry concepts involved in proving the slope criteria for parallel and perpendicular lines and using them to solve geometric problems.
0	The student response contains insufficient evidence of an understanding of the Geometry concepts involved in proving the slope criteria for parallel and perpendicular lines and using them to solve geometric problems. As a result, the response does not merit any points

*Letters are used to distinguish between sample student responses that earned the same score (e.g., 4A and 4B).

Score Point 4A

This question has four parts.

Lines f and g and points P and Q are graphed on this coordinate plane.



- The equation of line f is $y = 2$.
- The equation of line g is $y = 2x - 1$.

Part A

Write an equation of the line that is parallel to line f and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$y = -1$, This is because an graph of a line that does not contain the x variable and only includes what y equals to is a horizontal line. Point P is at $-2, -1$ and that is included in $y = -1$'s range. Also the two lines f and the new line are parallel to one another as a result of having the same slope of 0.

Part B

Write an equation of the line that is parallel to line g and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$y = 2x + 3$ This is because a parallel equation means that it has the same slope but a different y intercept. And to find an equation that is parallel and passes through point P simply remove the y intercept leaving us with $y = 2x$, now simply plug in the value of P to get $-1 = -4$, now add the y intercept that would make this solution true, which is $+3$, leaving us with $-1 = -4 + 3$, $-1 = -1$ therefore $y = 2x + 3$ passes through point P and is parallel to line g .

Part C

Write an equation of the line that is **perpendicular** to line f and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

The perpendicular line to a horizontal line is a vertical one, and to get a vertical line you have to do $x = 3$, this creates a line that passes through point Q and is perpendicular to line f .

Part D

Write an equation of the line that is perpendicular to line g and passes through point Q . Show or explain how you got your answer.

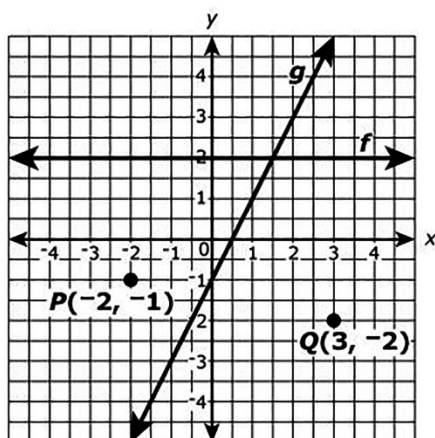
Enter your equation and your work or explanation in the space provided.

to get the perpendicular line, get the opposite reciprocal of $2x$, which is $-\frac{1}{2}x$. Now do what I did in part B, plug in the value of Q , $-2 = -1.5$ and make the statement true by adding the y intercept, $.5$, $-2 = -1.5 - 0.5$, therefore the answer is $y = -\frac{1}{2}x - \frac{1}{2}$.

Score Point 4B

This question has four parts.

Lines f and g and points P and Q are graphed on this coordinate plane.



- The equation of line f is $y = 2$.
- The equation of line g is $y = 2x - 1$.

Part A

Write an equation of the line that is parallel to line f and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

The equation of line f is $y = 2$ and point P is $(-2, -1)$. So a line parallel to line f would also have to be horizontal (slope is 0). If it passes through point P , the y coordinate would have to be -1 . So the equation would be $y = -1$.

Part B

Write an equation of the line that is parallel to line g and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

The equation of line g is $y = 2x - 1$. Point p is $(-2, -1)$. Because the resulting line has to be parallel, the slope would have to still be 2. However, we have to find the y -int that makes it go through point p .

$$y = 2x + b$$

$$-1 = 2 \times (-2) + b$$

$$-1 = -4 + b$$

$$b = 3$$

The answer is $y = 2x + 3$.

Part C

Write an equation of the line that is **perpendicular** to line f and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

The equation of line f is $y = 2$, which is a horizontal line. A line perpendicular to that would be vertical. Point Q is $(3, -2)$. In order for a vertical line to pass through that the x coordinate would have to be 3. The answer is $x = 3$.

Part D

Write an equation of the line that is perpendicular to line g and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

The equation of line g is $y = 2x - 1$. A line perpendicular to that would have an opposite reciprocal slope. So the slope would be $-\frac{1}{2}$. However, we need to find the y -*int* so that the line goes through point Q which is $(3, -2)$.

$$y = -\frac{1}{2}x + b$$

$$-2 = -\frac{1}{2} \times 3 + b$$

$$-2 = -\frac{3}{2} + b$$

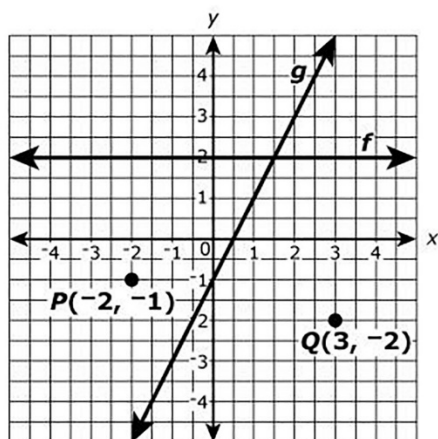
$$b = -\frac{1}{2}$$

$$\text{The answer is } y = -\frac{1}{2}x - \frac{1}{2}.$$

Score Point 3

This question has four parts.

Lines f and g and points P and Q are graphed on this coordinate plane.



- The equation of line f is $y = 2$.
- The equation of line g is $y = 2x - 1$.

Part A

Write an equation of the line that is parallel to line f and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$y = -1$ because the slope must be 0 because the line isn't going up and the -1 is because the point where I cross the y axis is -1 so the y intercept is -1

Part B

Write an equation of the line that is parallel to line g and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

the slope must be 2 because every time I have to go up 2 over 1 and the point where I cross the y axis is 3 which is y intercept if 3 so the equation is $y = 2x + 3$

Part C

Write an equation of the line that is **perpendicular** to line f and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

the equation is going to be $x = 3$ because I will have to stay straight up which means I don't have a slope and the point that I cross the x axis is 3 so x intercept of 3

Part D

Write an equation of the line that is perpendicular to line g and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

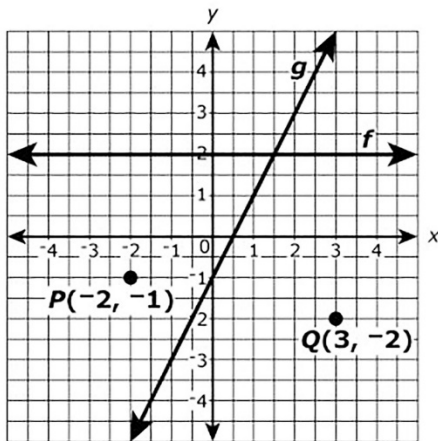
the equation is going to be
 $y = -2x + 4$ because the line is
going to be opsite slope is -2 instead
of 2 and the point where i cross the y
axis is 4 so y intercept of 4

[Back to Scoring Guide](#)

Score Point 2

This question has four parts.

Lines f and g and points P and Q are graphed on this coordinate plane.



- The equation of line f is $y = 2$.
- The equation of line g is $y = 2x - 1$.

Part A

Write an equation of the line that is parallel to line f and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$$y = -1$$

I chose this because -1 will go through point P and it is parallel to line f.

Part B

Write an equation of the line that is parallel to line g and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$$y = 1x + 2$$

I chose this because the slope will go through point P and will also be parallel to line g.

Part C

Write an equation of the line that is perpendicular to line f and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$$x = 3$$

With this equation it will make sure the line goes through f and point Q . There is no slope so the line is going straight up and down and perpendicular to line f .

Part D

Write an equation of the line that is perpendicular to line g and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

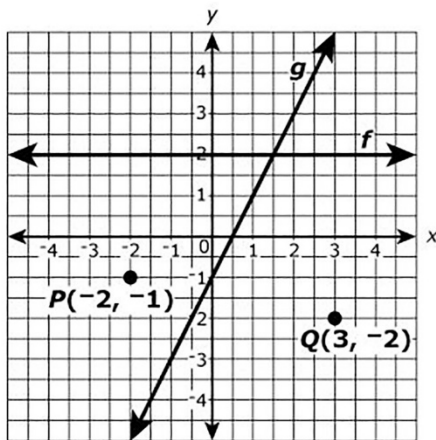
$$y = 1x + 1$$

This will go through point Q and line g because the slope and y - *intercept* values allow it to.

Score Point 1

This question has four parts.

Lines f and g and points P and Q are graphed on this coordinate plane.



- The equation of line f is $y = 2$.
- The equation of line g is $y = 2x - 1$.

Part A

Write an equation of the line that is parallel to line f and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$$y = -1$$

I chose this equation because the line needed to go through point P while also being parallel to line F. To do that it needed to not go through it so I went down to the same line as point P and did that for my line.

Part B

Write an equation of the line that is parallel to line g and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$$y = 1x + 1$$

I chose this as my line because this line needed to be parallel to line g by also going through point P.

Part C

Write an equation of the line that is **perpendicular** to line f and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$$y = 2x + 2$$

this line goes f and starts at point Q. I chose this because it was the perfect equation to get through both point Q and to be perpendicular to line F.

Part D

Write an equation of the line that is **perpendicular** to line g and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

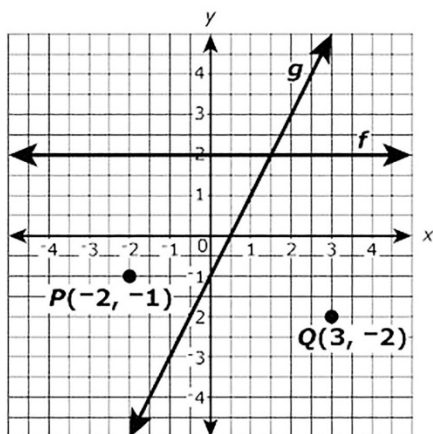
$$y = 3x + 5$$

this line goes through line G while also going through point Q

Score Point 0

This question has four parts.

Lines f and g and points P and Q are graphed on this coordinate plane.



- The equation of line f is $y = 2$.
- The equation of line g is $y = 2x - 1$.

Part A

Write an equation of the line that is parallel to line f and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$y = 2x + 0$ because the line starts on 2 on the x axis and then it passes through zero which is the origin of the grid.

Part B

Write an equation of the line that is parallel to line g and passes through point P . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$y = -2x + -3$ because it starts on two on the x axis and for line G to pass through P it has to travel -3 and end n -3 on the Y axis.

Part C

Write an equation of the line that is **perpendicular** to line f and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$y = 2x + 1$ because you need to travel 1 from $2x$.

Part D

Write an equation of the line that is perpendicular to line g and passes through point Q . Show or explain how you got your answer.

Enter your equation and your work or explanation in the space provided.

$y = 1x + 3$ for it to be perpendicular it has to start on 2x and then travel 3.

[Back to Scoring Guide](#)