(DN) Describe 3 or more examples of parallel lines in the world. Where do you see them? Sketch if it helps your description.

Name _____**Per**_____

SLO: I can construct **parallel lines** in 3 different ways and explain how the construction guarantees parallel lines


☐ (1)   **Constructing parallel lines without transformation** Construct line *p* parallel to line *n*.
compass

☐ (a) Make a sketch that shows $\overleftrightarrow{AB} \perp \overleftrightarrow{CD}$ and $\overleftrightarrow{EF} \perp \overleftrightarrow{CD}$ (⊥ means perpendicular which means _____ angles.)

What relationship do you see between $\overleftrightarrow{AB}$ and $\overleftrightarrow{EF}$? _____

☐ (b) Construct line *m* so that it is perpendicular to the given line *n* below. (Line *m* can be constructed anywhere as long as it is perpendicular to line *n*.) Label the line you construct line *m*.

←————————————————————————————→ *n*
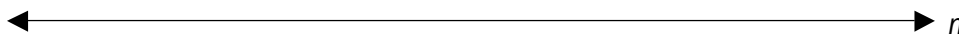
☐ (c) Now you have line *m* and line *n*. You must construct another perpendicular line. Should it be perpendicular to line *m* or line *n*? _____ (HINT: look back at the very first direction for problem #1 and use the directions to help you visualize what you need to do.)

☐ (d) Construct line *p* as you described it in part *b*.

☐ (e) When two lines (*p* and *n*) are perpendicular to the same line (line *m*), the two lines are _____.
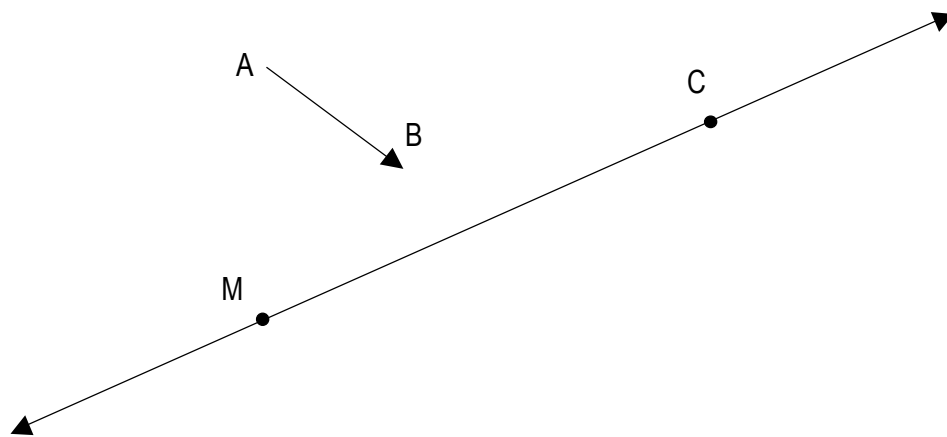
☐ **(2)** **Constructing parallel lines by translation**
compass

   ☐ (a) Make a sketch that shows $\overleftrightarrow{AB}$ and a translation of $\overleftrightarrow{AB}$ labeled $\overleftrightarrow{A'B'}$

     The two lines are parallel because _____

   ☐ (b) If you translate a line, the fewest number of points you will have to translate is _____ because _____

     _____.

   ☐ (c) Use a compass and straightedge to perform the function $T_{\overrightarrow{AB}}\,(\overleftrightarrow{MC})$. REFERENCE: Lesson 2.7

       $T_{\overrightarrow{AB}}\,(\overleftrightarrow{MC})$ means _____

☐ **(3)** **Constructing parallel lines by rotation**

weblink
compass

☐ (a) Use the weblink for this lesson or transparencies to determine how many degrees a line must be rotated around a point for the image line to be parallel to the preimage line.

(1) A line must be rotated _____ around a point for the image to be parallel to the preimage.

(2) The point that we rotate around must be **on/not on** (circle one) the line we are rotating.

☐ (b) How can we rotate a point _____ (see part a) around a center of rotation? Rotate the points below to help you answer this question.

(i) ☐ Rotate B _____ around point R   (ii) ☐ Rotate Z _____ around point C

.B

˙R

.C

.Z

So, how can we rotate a point _____ around a center of rotation? _____

_____

_____

_____

☐ (c) To rotate a line _____° (see part a), we must have a point to rotate around, and _____ points on the line that we will rotate. To have parallel lines, we must rotate around a point that **is/is not** (circle one) on the line.

☐ (d) Construct $\overleftrightarrow{A'U'}$ parallel to $\overleftrightarrow{AU}$ by performing the function $R_{C,180°}(\overleftrightarrow{AU})$.

$R_{C,180°}(\overleftrightarrow{AU})$ means _____

•C

A   U

☐ (4)   **Parallel Lines by rotation PROOF**
☐ Prepare your mind to prove that rotating a line 180° around a point not on the line ALWAYS results in parallel lines.

(a) ☐ True or false: Two lines in a plane are either **parallel** or **not parallel**. _____

(b) ☐ Lines are not parallel if they _____ .

(c) ☐ True or false: A point can be on a line and not on the line at the same time. _____

(d) ☐ A **contradiction** happens when a claim is made that two things happen at the same time which cannot possibly happen at the same time. For example: Ms. Lomac is in Albany and in Rochester right now. Write your own contradiction:

_____

☐ Prove that rotating a line 180° around a point that is not on the line ALWAYS results in parallel lines. The easiest way to prove this is by contradiction. Use the Geogebra file on Ms. Lomac's website to see what is happening at each step by checking the box. (http://rcsdk12.org/Page/32037)

Start your proof by **contradiction** by assuming the OPPOSITE of what you want to prove.

1. Assume that rotating $\overleftrightarrow{AB}$ 180° around point C not on $\overleftrightarrow{AB}$ _____ result in parallel lines.

2. Since the lines are not parallel, then $\overleftrightarrow{A'B'}$ must _____ $\overleftrightarrow{AB}$ in some point X on $\overleftrightarrow{AB}$ and $\overleftrightarrow{A'B'}$.

3. Since $\overleftrightarrow{A'B'}$ is a rotation of $\overleftrightarrow{AB}$ there must exist a point X' on $\overleftrightarrow{A'B'}$ such that _____ is a diameter of circle C.

4. Since both X and X' must be on $\overleftrightarrow{A'B'}$ and $\overline{XX'}$ must contain C (since it is a diameter), then point C must be on _____. (Drag points to convince yourself that C must be on $\overleftrightarrow{A'B'}$ and $\overline{XX'}$.)

5. In step 1, we said that point C is not _____. If point C _____ then it cannot be on _____ . But, in step 5 we said that point C must be on _____. This is impossible because point C cannot be _____ AND _____ .

Since this is a contradiction, our assumption that rotating $\overleftrightarrow{AB}$ 180° around point C not on $\overleftrightarrow{AB}$ _____ result in parallel lines _____ true. The only alternative to our assumption is that _____

_____

☐ **(5)** **Parallel Lines by translation practice**

compass
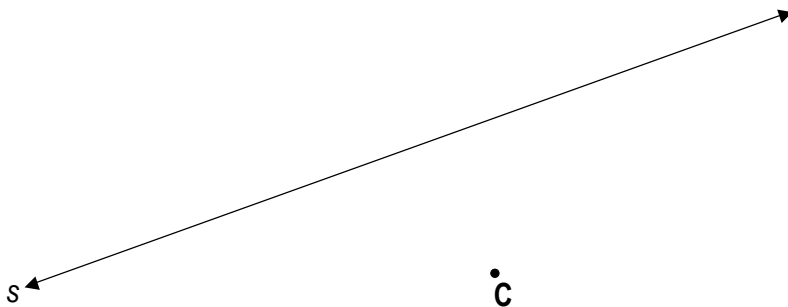
☐ (a) Construct parallel lines using distance and direction to translate. Use #2 to help you or the guidance below.

P'•

⟵―――――――――――――――――――――――⟶

(i) ☐ To construct a specific line, we need _____ points.

(ii) ☐ Choose 2 points on the line. Label them points P and Q. (It will be easiest if P is left of Q)

(iii) ☐ To translate line PQ so that it passes through P', we must recognize that P' is an image of P. We will
need to construct point Q' so that the line is translated along the vector _____.

(iv) ☐ Measure the distance from _____ to _____ and use the distance to construct circle _____.

(v) ☐ Measure the distance from _____ to _____ and use the distance to construct circle _____.

(vi) ☐ Label Q' and connect to make P'Q'.

(vii) ☐ Which line P'Q' is parallel to line PQ because _____ and _____
are preserved under translation.

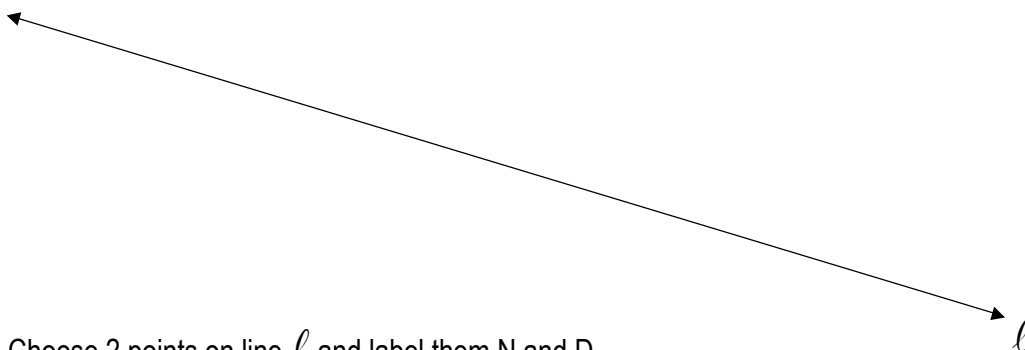☐ (b) Construct a line parallel to line *s* that passes through point C.

s

•
C

☐ (6) **Parallel Lines by rotation practice**

compass

☐ (a) Construct parallel lines using by rotation. Use #3 to help you or the guidance below.

⋅D'

ℓ

☐ Choose 2 points on line ℓ and label them N and D.

☐ Draw line segment DD'.

☐ Construct the midpoint of $\overline{DD'}$ and label it O.

You can fold to check your construction, but you must construct the perpendicular bisector of $\overline{DD'}$.

Why does a perpendicular bisector locate the midpoint? _____

_____

☐ Construct the rotation of line ℓ 180° around point O by rotating N (D is already rotated).

☐ Label the image N'

☐ Construct the line containing D' and N'.

☐ (b) Use rotation to construct a line parallel to line MP that passes through point C. (C can be an image of M or P, you decide.)
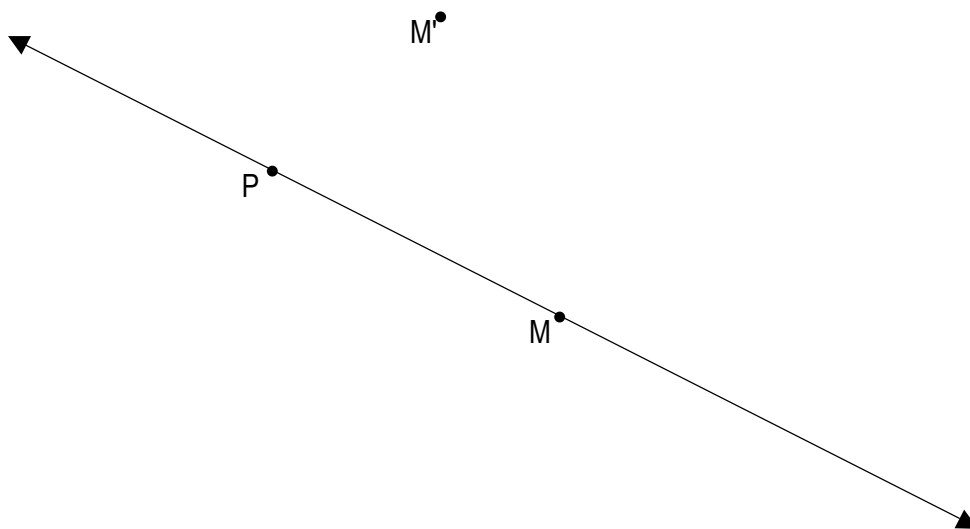
P

M

⋅C
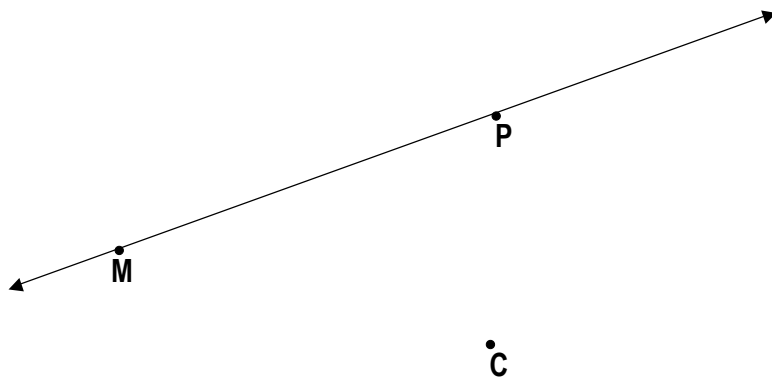
☐ (7) **Exit Ticket**

☐ Describe the three ways to construct parallel lines. State the method you like best and what you like about the method.
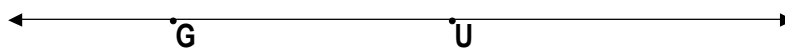

☐ (8) **Homework**

compass

☐ (1) Use translation to construct a line parallel to line MP that passes through M'.

M'●

P

M

☐ (2) Construct $\overleftrightarrow{G'U'}$ parallel to $\overleftrightarrow{GU}$ by choosing a point L not on $\overleftrightarrow{GU}$ and rotating $\overleftrightarrow{GU}$ 180° around point L

G   U

☐ L is the midpoint of _____ and _____

because_____

☐ (8) **Homework**

cont

☐ (3) In the space below, draw your own line and construct a parallel line by the method stated.

☐ (a) Constructing 2 perpendicular lines

☐ (b) Translation

☐ (c) Rotation