ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL THREE

INSTRUCTIONAL GUIDE

SECTION 4

EO M390.04 – DETERMINE DISTANCE ON A MAP AND ON THE GROUND

Total Time: 90 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-803/PG-001, Chapter 4. Specific uses for said resources are identified throughout the instructional guide within the TP for which they are required.

Review the lesson content and become familiar with the material prior to delivering the lesson.

Create five 'point-to-point' and five 'along a route between two points' distances for the topographical map being used. Four- and six-figure grid references (GRs) should be used to designate the start and end points.

Measure and mark three 100-m pace courses. One should be on a flat trail/road, another through light bush, and the last through heavier bush, with slopes if possible. Pace courses should be wide enough to allow several cadets to use them at the same time.

Calculate personal pace for 100 m.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

Demonstration and performance was chosen for TPs 1 and 2 as it allows the instructor to explain and demonstrate measuring distances on a map and determining personal pace, while providing an opportunity for the cadet to practice these skills under supervision.

An interactive lecture was chosen for TP 3 to introduce the factors that can affect the cadets' personal pace.

A practical activity was chosen for TP 4 as it is an interactive way for the cadet to experience pacing and the factors that affect it in a safe, controlled environment. This activity contributes to the development of pacing skills and knowledge in a fun and challenging setting.

INTRODUCTION

REVIEW

The following questions are a review of EO M390.03 (Determine Grid References [GRs], Section 3).

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QUESTIONS

Q1. What are eastings?

Q2. Which grid line intersection is used to represent a grid square?

Q3. What is a romer?

ANTICIPATED ANSWERS

A1. Similar to the X-axis in mathematical graphing, eastings are a series of vertical parallel lines plotted as an overlay to the map sheet, which are drawn from top to bottom and numbered, with two digits, sequentially from west to east. They run north-south, similar to lines of longitude.

A2. The grid lines that intersect in the bottom left corner of the grid square are used to identify that grid square.

A3. A device used for measuring a point within a grid square to determine its six-figure GR.

OBJECTIVES

By the end of this lesson the cadet shall have determined distance on the map and on the ground.

IMPORTANCE

It is important for cadets to be able to accurately determine distance on the map and on the ground in order to effectively use a topographical map to plot a route that will be followed on the ground.

Teaching point 1 — **Explain, Demonstrate and Have the Cadet Determine Distance on a Map**

Time: 30 min — Method: Demonstration and Performance



For this skill lesson, it is recommended that instruction take the following format:

(1) Explain and demonstrate the complete skill while cadets observe.

(2) Explain and demonstrate each step required to complete the skill. Monitor cadets as they imitate each step.

(3) Monitor the cadets' performance as they practice the complete skill.

Note: Assistant instructors may be used to monitor cadet performance.

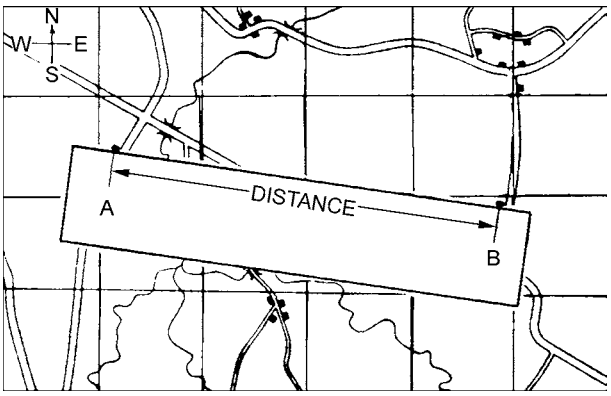
DETERMINING DISTANCE ON A MAP

Cadets can use a map to measure the distance between two points (eg, points A and B as illustrated at Figure 18-4-1) on the ground. All maps are drawn to scale; therefore, a specified distance on a map equals a specified distance on the ground. The scale of a map is printed at the top and bottom of each map (eg, scale 1 : 50 000). This means that 1 cm on the map equals 50 000 cm (500 m) on the ground.

There are two ways to determine distance on a topographical map – point-to-point and along a route.

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Measuring Point-to-Point



Director Cadets 3, Royal Canadian Army Cadet Reference Book, Department of National Defence (p. 5-24)

Figure 1 Measure Distance Point-to-Point

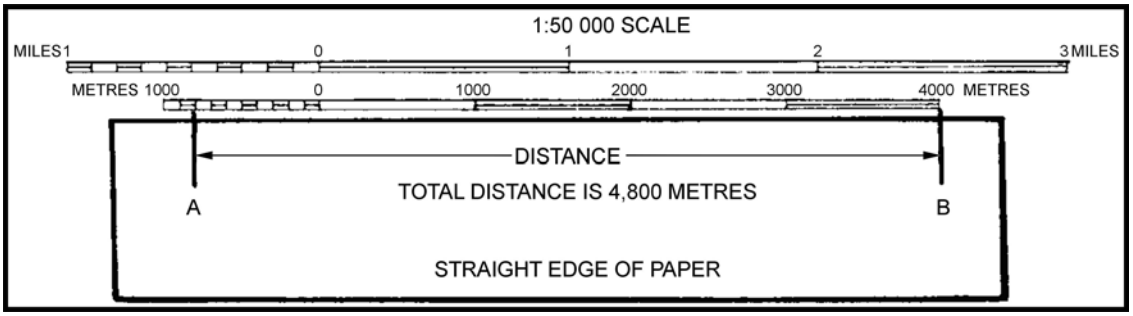
To measure a distance point-to-point:

1. Lay the straight edge of a piece of paper against the two points.

2. With a sharp pencil, mark the paper at the A (start) and B (end) points.

3. Lay the paper just under the metres scale bar with the B mark at the right end of the scale. Move the paper to the left aligning the B mark with each thousand metre mark until the A mark falls within the subdivided thousands (hundreds) to the left of the zero.

4. To calculate the total distance, add the number of thousands where the B mark is, plus the number of subdivided thousands where the A mark is to the left of the zero.



Director Cadets 3, Royal Canadian Army Cadet Reference Book, Department of National Defence (p. 5-25)

Figure 2 Calculate Distance

For a distance that is longer than 5 000 m, measure the first 5 000 m and mark the paper with a new line and label it ‘5 000 m’. Place the new mark at the zero or thousands mark until the A mark fits within the subdivided thousands (hundreds) bar. Add the total of that distance to the 5 000 m to create the total distance.

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Measuring Along a Route Between Two Points

Sometimes cadets need to find the distance between A and B around the curves in a road along a planned route.

To measure a distance along a route between two points:

1. Lay the straight edge of a piece of paper against point A.

2. With a sharp pencil, mark point A on the paper and the map.

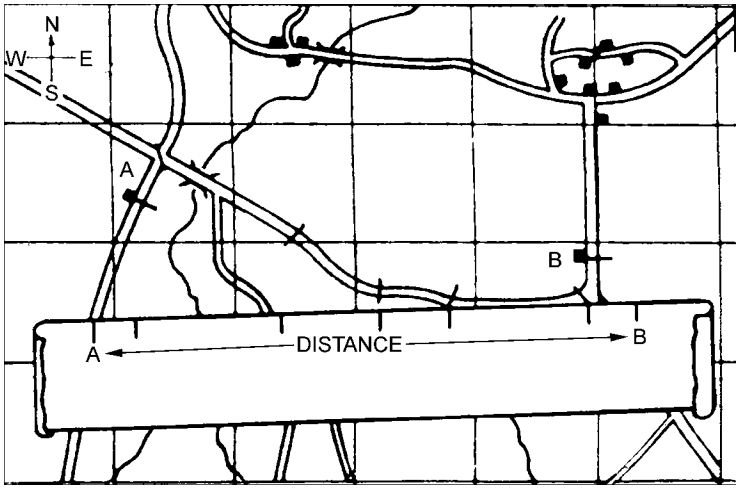
3. Line up the paper with the edge of the road until a curve is reached and make another mark on the paper and on the map.

4. Pivot the paper so that it continues to follow the road edge. Repeat until you reach point B.

5. Mark the paper and the map at point B.

6. Lay the paper just under the metres scale bar with the B mark at the right end of the scale. Move the paper to the left aligning the B mark with each thousand metre mark until the A mark falls within the subdivided thousands (hundreds) to the left of the zero.

7. Add the number of thousands where the B mark is, plus the number of subdivided thousands (hundreds) where the A mark is to the left of the zero, to determine the total distance.



Director Cadets 3, Royal Canadian Army Cadet Reference Book, Department of National Defence (p. 5-25)

Figure 3 Measure Distance Along a Route

ACTIVITY

Time: 15 min

OBJECTIVE

The objective of this activity is to have the cadets measure distance on a map.

RESOURCES

- Topographical map,
- Paper, and

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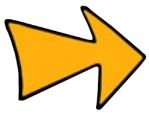
- Pencil.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Divide the cadets into pairs.
2. Distribute a map to each pair.
3. Have the cadets determine the distance:
   a. point-to-point, and
   b. along a route.
4. Check answers.
5. Repeat Steps 3. to 4. until complete or the time is up.



All marks should be carefully erased from the map after each distance is determined.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 1

The cadets' participation in determining distance on a map will serve as the confirmation of this TP.

Teaching point 2 **Explain, Demonstrate and Have the Cadet Pace**

Time: 15 min Method: Demonstration and Performance



For this skill lesson, it is recommended that instruction take the following format:

(1) Explain and demonstrate the complete skill while cadets observe.

(2) Explain and demonstrate each step required to complete the skill. Monitor cadets as they imitate each step.

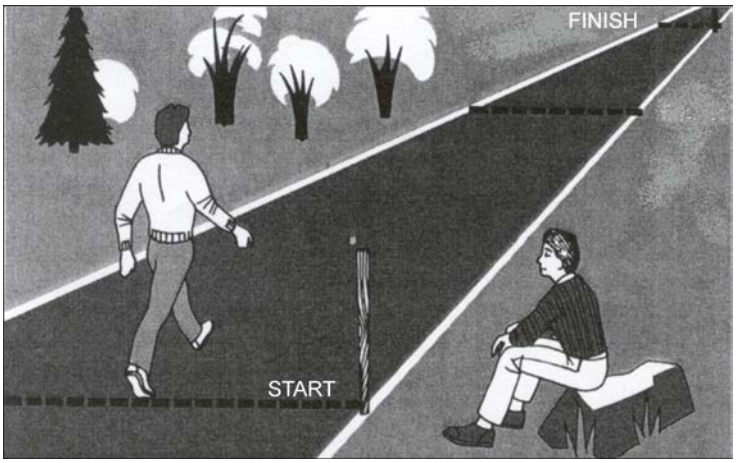
(3) Monitor the cadets' performance as they practice the complete skill.

Note: Assistant instructors may be used to monitor cadet performance.

DETERMINING A PERSONAL PACE FOR 100 M

Being able to determine distance is a key skill for ground navigation. By learning how to determine distance using a personal pace, a cadet will have the skill to determine how far they have travelled, and how far they have to travel to reach their destination.

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B. Kjellstrom, Be Expert With Map & Compass, Hungry Minds, Inc. (p. 53)

Figure 4 Determining Distance Using Pacing

Personal Pace. The number of paces a person walks over a distance of 100 m.

COUNTING PACES

There are two basic methods to count pace:

- count every pace (count every step); or
- count every other pace (count every left or every right step).

For example:

- count every pace: 140 paces = 100 m; or
- count every other pace: 70 paces = 100 m.

CALCULATING DISTANCE

In order to determine distance travelled, the total number of paces travelled is divided by the personal pace and multiplied by 100 m to calculate the number of metres travelled.

Formula:

$$\frac{\text{total number of paces}}{\text{personal pace}} \times 100 \text{ m} = \text{total distance travelled (m)}$$

Example:

$$\frac{140 \text{ paces}}{70} \times 100 \text{ m} = 200 \text{ m}$$

Common methods of keeping track of the number of paces travelled include:

- transferring pebbles from one pocket to another: one pebble for each 100 paces;
- using a length of cord with knots – the knotted cord is held with the hand gripping a knot and the hand is advanced one knot down the cord for every 100 paces; and

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- combining the knotted cord and pebbles (eg, cord with 10 knots, pebbles transferred for each completed cord [10 knots x 100 paces each = 1000 paces/pebble]).

ACTIVITY

Time: 10 min

OBJECTIVE

The objective of this activity is to have the cadets determine their personal pace.

RESOURCES

- Calculator (one per pair of cadets),
- Paper, and
- Pen/pencil.

ACTIVITY LAYOUT

Measure a 100-m course and mark it with a clearly defined start and end point on a flat trail/road.

ACTIVITY INSTRUCTIONS

1. Have the cadets walk the pace course, counting out loud, being careful to keep an accurate count.
2. Have the cadets walk the pace course three times, noting their pace count each time.
3. Have the cadets calculate their personal pace by averaging their three pace counts.
4. Have the cadets record their personal pace.



Do not walk with someone when determining a personal pace. When people walk together, they automatically adjust their pace length to match the other person's in order to stay together.

SAFETY

Boundaries must be marked and supervised.

CONFIRMATION OF TEACHING POINT 2

The cadets' participation in determining personal pace will serve as the confirmation of this TP.

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Teaching point 3 **Describe Factors That Affect Pacing**

Time: 5 min Method: Interactive Lecture

FACTORS THAT AFFECT PACING



This teaching point should be presented by asking the cadets what they think could affect their personal pace. Ensure to cover any points that are not suggested by the cadets.

Factors that will affect personal pace include:

Terrain. The rougher the ground, the shorter the pace.

Slopes. Pace is shorter going uphill and longer going downhill.

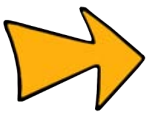
Fatigue. Will shorten a person's pace.

Equipment. Footwear with poor traction will shorten a person's pace. Carrying a heavy load will also shorten a person's pace.

Weather. Snow and rain will shorten a person's pace. The wind will increase/decrease pace length if a person is travelling with/against the wind.

Obstacles. Going around small features (eg, trees, bushes) will affect pace count unless compensated for. Compensation methods include:

- **Sidestepping.** Stepping to the side (left/right) enough paces to bypass the obstacle, pacing forward past the obstacle and sidestepping back (right/left) to return to the original line of travel. This method maintains pace accuracy, but takes time.



The paces that the cadets sidestep are not added to their total pace count.

- **Alternating sides.** In this method, the cadet alternates which side (left/right) of the obstacle they pass (eg, last obstacle was passed on the left, next will be on the right). This method is less accurate, but faster.



If obstacles are always bypassed on the same side, the line of travel will veer off in that direction unless a distant steering point (eg, tall tree, hill top, building) is used as a guide.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. How does slope affect pace?

Q2. How will weather affect pace?

Q3. What can happen if you always bypass obstacles on the same side?

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ANTICIPATED ANSWERS

A1. Pace is shorter going uphill, and longer going downhill.

A2. Snow and rain will shorten a person's pace, the wind will increase/decrease pace length if a person is travelling with/against the wind.

A3. The line of travel will veer off in that direction unless a distant steering point (eg, tall tree, hill top, building) is used as a guide.

Teaching point 4 **Demonstrate and Have the Cadet Practice Determining Distance Using the Pace-Counting Method Over Varied Terrain**

Time: 30 min Method: Practical Activity



This activity combines the cadets' personal pace determined in TP 2 with the knowledge taught in TP 3. This allows the cadets to gain experience pacing and the effect varied terrain will have on their pace.

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets determine their personal pace over varied terrain.

RESOURCES

- Calculator (one per pair of cadets),
- Paper, and
- Pen/pencil.

ACTIVITY LAYOUT

Measure two 100-m pace courses and mark each of them with clearly defined start and end points. One should be through light bush and the second through heavier bush, with slopes if possible.

ACTIVITY INSTRUCTIONS

1. Inform the cadets that they will be using their personal pace on two courses to determine the effect of terrain on pace.

2. Divide the cadets into two groups. Assign one group to each course.

3. Have the cadets, individually, pace the course five times, and then determine the difference between this count and their personal pace.

4. After 15 minutes, have the cadets switch courses.

5. Have the cadets, individually, pace the course five times, and then determine the difference between this count and their personal pace.

6. Have the cadets record their findings.

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SAFETY

Boundaries must be marked and supervised.

CONFIRMATION OF TEACHING POINT 4

The cadets' participation in the pacing activities will serve as the confirmation of this TP.

END OF LESSON CONFIRMATION

The cadets' participation in determining distance on a map and determining their personal pace will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

This EO is assessed IAW A-CR-CCP-803/PG-001, Chapter 3, Annex B, Appendix 5 (390 PC).

CLOSING STATEMENT

It is important for cadets to be able to accurately determine distance on the map and on the ground in order to effectively use a topographical map to plot a route that will be followed on the ground. The skill gives the map reader confidence in their ability to know where they are at all times.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A2-041 (B-GL-382-005/PT-001) Canadian Forces. (2006). *Maps, Field Sketching, Compasses and the Global Positioning System*. Ottawa, ON: Department of National Defence.

C0-111 (ISBN 978-0-9740820-2-8) Tawrell, P. (2006). *Camping and Wilderness Survival: The Ultimate Outdoors Book* (2nd ed.). Lebanon, NH: Leonard Paul Tawrell.

C2-041 (ISBN 0-07-136110-3) Seidman, D., & Cleveland, P. (1995). *The Essential Wilderness Navigator*. Camden, ME: Ragged Mountain Press.

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