ROYAL CANADIAN SEA CADETS

PHASE TWO

INSTRUCTIONAL GUIDE

SECTION 4

EO M221.04 – IDENTIFY COMPONENTS OF TACKLES

Total Time: 30 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-602/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.

Prepare and rig the tackles that are to be presented during this lesson.

Photocopy the labels located at Annex A. Photocopy the handout located at Annex B for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1, TP3, and TP4 as it allows the instructor to introduce components of tackles and to create interest in ropework.

An in-class activity was chosen for TP2 as it is an interactive way to provoke thought, stimulate interest, and to confirm the cadets' comprehension of the parts of the tackle.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall identify components of tackles.

IMPORTANCE

It is important for cadets to know the components of tackles to understand how to use tackles at the maximum efficiency possible with minimal effort. The concepts surrounding tackles will provide assistance when completing future seamanship based tasks.

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Teaching point 1 **Describe Tackles**

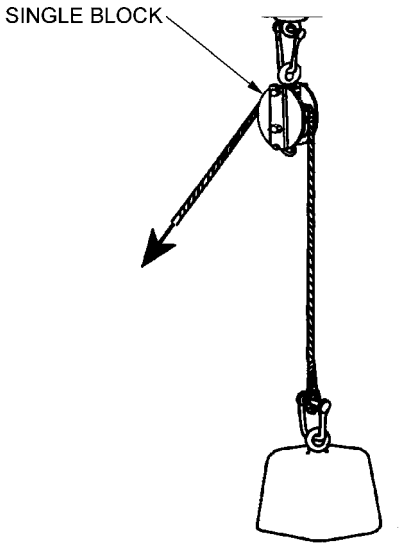
Time: 10 min Method: Interactive Lecture

WHAT IS A TACKLE (PRONOUNCED “TAYCKLE”)?

A purchase is a mechanical device to which an applied pull or force is increased. A tackle is a purchase consisting of a rope rove through a block or multiple blocks, providing assistance to lifting a load. The amount of force of the pull required to lift a load is dependent on the number of sheaves in the blocks and the manner in which the rope is rove through them.

TYPES OF TACKLES

Single Whip. This is a tackle consisting of a line rove through a single block. It is used for hoisting light loads, and where speed of hoisting is an important factor.

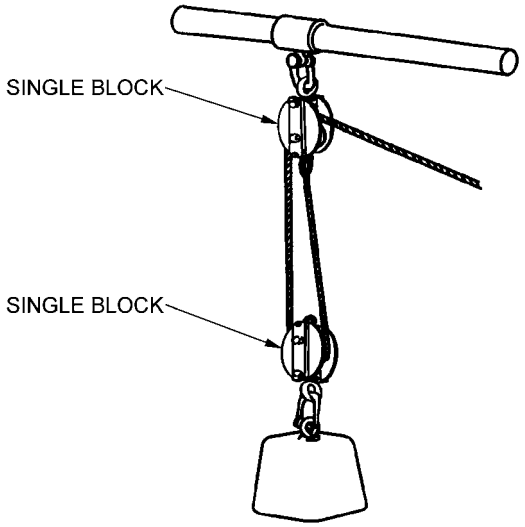


B-ON-050-002/PT-004, BR 67 Admiralty Manual of Seamanship (p. 3-154)

Figure 1 Single Whip

Double Whip. This is a tackle consisting of a line rove through two single blocks. It is mainly used for hoisting loads.

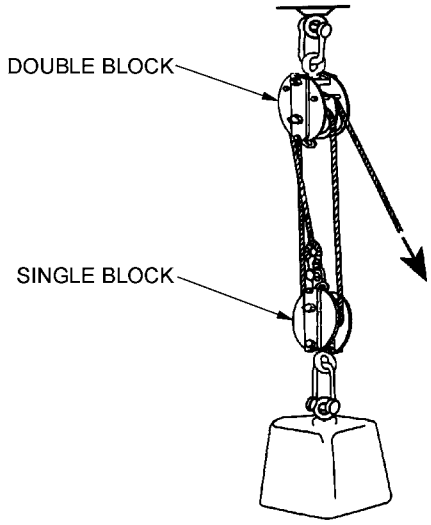
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Figure 2 Double Whip

Luff. This is a tackle consisting of a line rove through a single and double block.

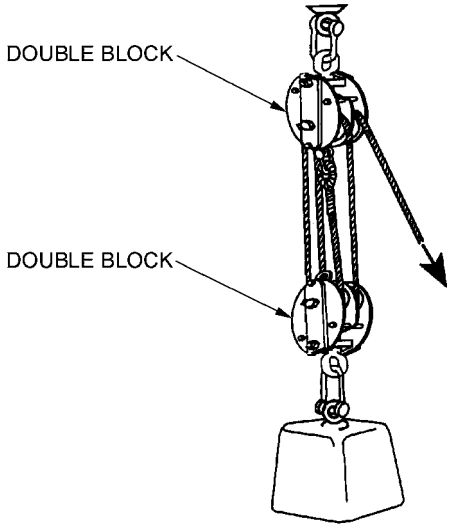


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Figure 3 Luff

Two-fold Purchase. This is a tackle consisting of a piece of line rove through two double blocks. It is a useful general-purpose tackle, as it provides the greatest assistance of the four tackles described in this lesson.

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Figure 4 Two-fold Purchase

The type of tackle used will depend on the assigned task. Things to consider will be, blocks available, length of line available, weight of the load, distance the load is to be moved, location, and the strength and number of people available to control the tackle.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is a single whip tackle?

Q2. What blocks make up a luff?

Q3. What tackle is considered a useful general-purpose tackle?

ANTICIPATED ANSWERS

A1. A line rove through a single block.

A2. A single and a double block.

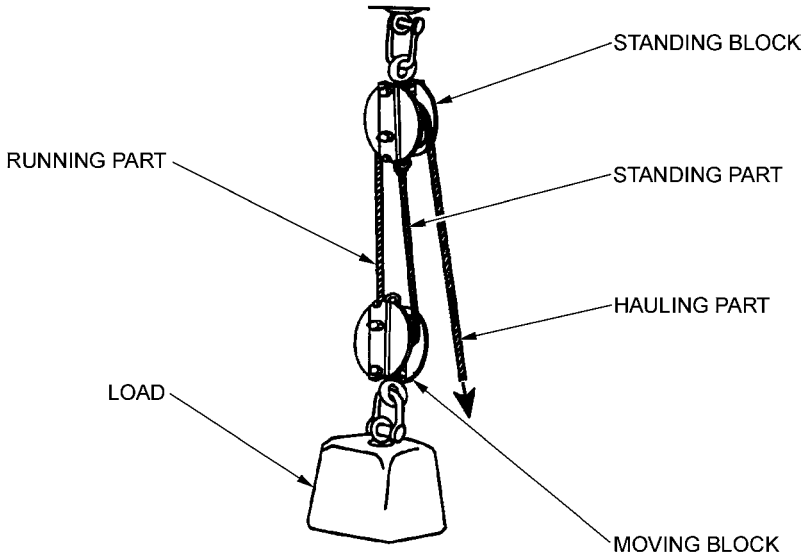
A3. A two-fold purchase.

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Teaching point 2 **Describe the Parts of a Tackle**

Time: 10 min Method: In-Class Activity

PARTS OF A TACKLE



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Figure 5 Parts of a Tackle

Standing Block. This block is attached to a fixed surface and does not move when the tackle is being used.

Standing Part. This is the line attached to the standing block and is rove through the moving block.

Hauling Part. This is either hauled or eased out to hoist, lower, or move the load.

Moving Block. This block is attached to the load being hoisted/lowered/moved and moves when the hauling part is pulled or eased out respectively.

Running Part. This is the line that is rove through the moving and standing block.

Load. Any item or load, connected to a tackle, being hoisted or moved from one point to another.

ACTIVITY

Time: 5 min

OBJECTIVE

The objective of this activity is to review the parts of a tackle.

RESOURCES

- Two single blocks.
- Two metres of line.
- A load of 22 kg (50 lbs) or less.

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- Tackle labels located at Annex A to this EO.
- Tape.

ACTIVITY LAYOUT

Rig two double whip tackles and place them in the front of the class.

ACTIVITY INSTRUCTIONS

- Divide cadets into two groups.
- Provide each team with a set of tackle labels and tape.
- Assign each group to a double whip.
- Have each group label the double whip.

SAFETY

N/A.



If there is a large group, make additional sets of labels and double whips.

CONFIRMATION OF TEACHING POINT 2

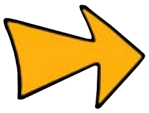
The cadets' participation in the activity will serve as the confirmation of this TP.

Teaching point 3 **Describe Mechanical Advantage**

Time: 20 min Method: Interactive Lecture

MECHANICAL ADVANTAGE

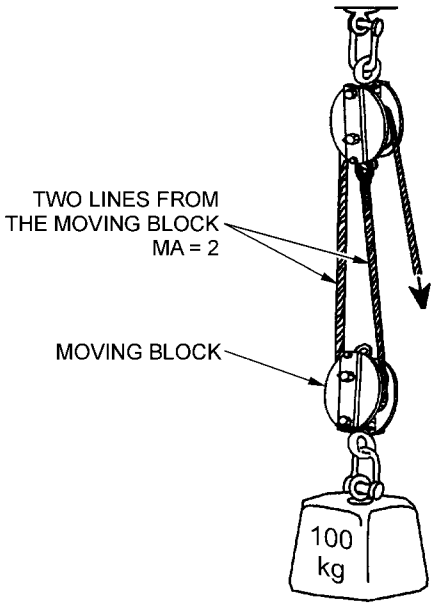
The amount by which the pull on the hauling part is multiplied by the tackle is called the mechanical advantage (MA) and, if friction is disregarded, this is equal to the number of parts of line emerging from the moving block.



For the point of this lesson friction will be disregarded.

Figure 6 is an example of the MA in a tackle. There are two lines attached to the moving block, therefore the MA equals two.

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Figure 6 Mechanical Advantage

The MA will change how heavy the load feels to the person(s) pulling on the hauling part. For example, in Figure 6 the MA equals two. Therefore, the weight felt would equal 50 kg for the 100 kg load, meaning the weight felt is equal to 1/2 the actual weight of the load.

The following formula is an easy way to determine the weight felt by the hauling part.

WEIGHT = (1 / MA) x Actual Load Weight

Example:

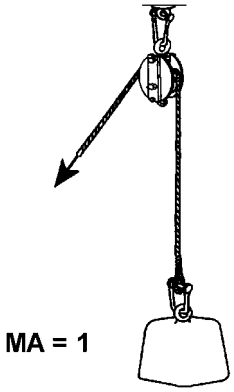
MA equals three, load weight equals 300 kg

WEIGHT = (1/3) x 300 kg

WEIGHT = 100 kg

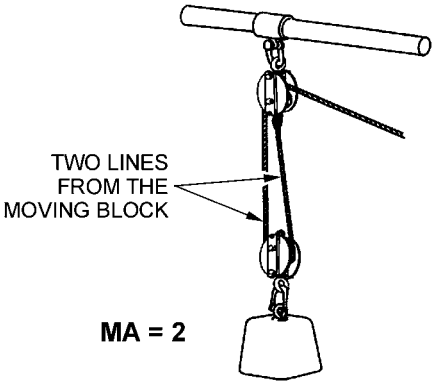
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MECHANICAL ADVANTAGE IN TACKLES



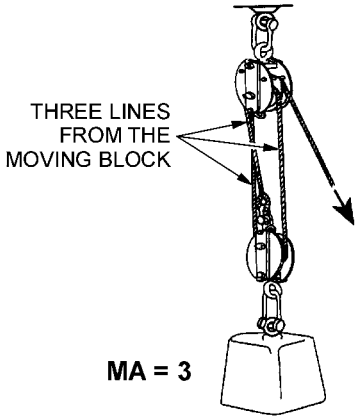
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Figure 7 Single Whip MA



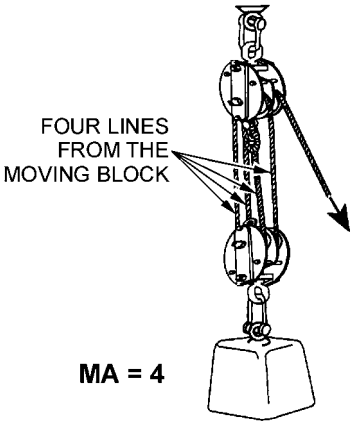
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Figure 8 Double Whip MA



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Figure 9 Luff MA



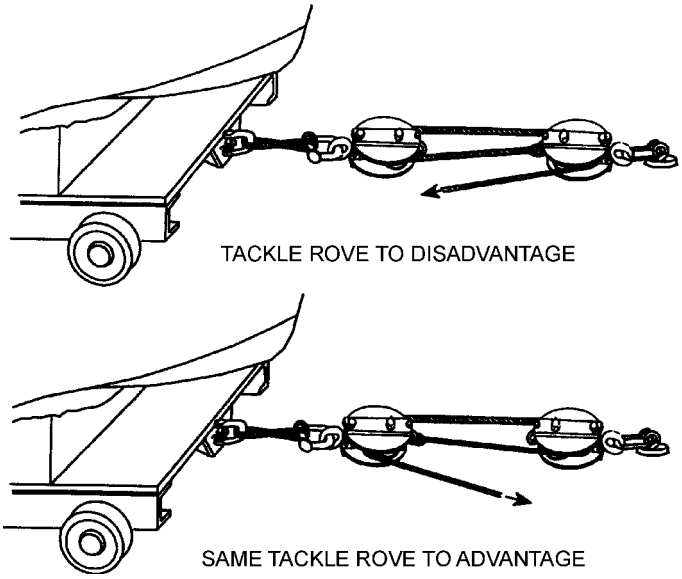
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Figure 10 Two-Fold Purchase MA

RIGGING TO ADVANTAGE AND DISADVANTAGE

If a tackle from Figure 8 to Figure 10 was flipped upside down there would be an extra part of the line emerging from the moving block. The MA would therefore increase by one. When a tackle is rigged to this maximum MA it is rigged to advantage. When the tackle is rigged as in Figures 8 and 9 it is rigged to disadvantage. The single whip provides no advantage. The weight felt on the hauling part will be the actual weight of the load.

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Figure 11 Rigging to Advantage and Disadvantage

Tackle	MA When Rigged to Disadvantage	MA When Rigged to Advantage
Single Whip	1	1
Double Whip	2	3
Luff	3	4
Two-Fold Purchase	4	5

D Cdts 3, 2007, Ottawa, ON: Department of National Defence

Figure 12 Advantage vs. Disadvantage



Normal use of tackles will result in many tackles being rigged to disadvantage as it is easier to pull downwards on the hauling part. To maximize MA, change the direction of pull by reeving the hauling part through an additional single block.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What is the MA of a double whip rigged to disadvantage?

Q2. If the MA equals two and the actual load weight equals 500 kg, what is the weight felt by the hauling part?

Q3. What is the MA of a two-fold purchase when rigged to advantage?

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ANTICIPATED ANSWERS

A1. Two.

A2. 250 kg.

A3. Five.

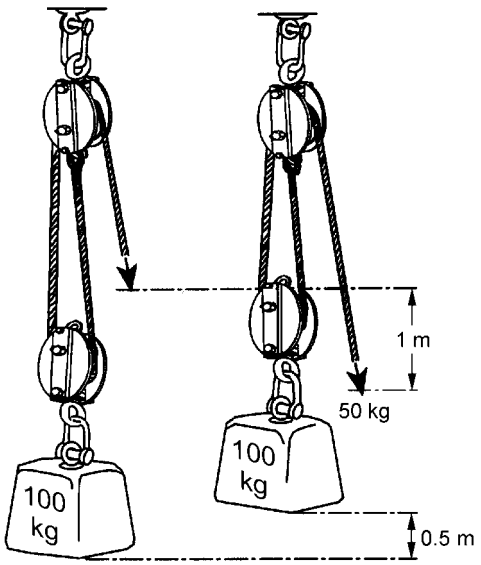
Teaching point 4 **Describe Velocity Ratio**

Time: 10 min Method: Interactive Lecture

VELOCITY RATIO

The ratio between the distance moved by the hauling part and the distance moved by the moving block is known as velocity ratio (VR) and is always equal to the number of parts of the line coming from the moving block.

The VR is directly related to the amount of MA of a tackle. MA is gained only at the expense of speed of work, or how much you must pull in order to move a load a desired distance. If the MA is increased so is the VR, therefore, requiring more line to move a load the desired distance.



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Figure 13 Velocity Ratio of a Tackle

In Figure 13, in order to raise the load 0.5 m the hauling part is required to move a distance of 1 m.

If the distance the load must be moved and the VR are known, calculate the hauling part distance using the following formula:

Hauling Part Distance = Distance the Load Must be Moved x VR

Example:

VR equals 2, distance the load must be moved 0.5 m.

Hauling Part Distance = 0.5 m x 2

Hauling Part Distance = 1 m

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CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. What is the term for the ratio between the distance moved by the hauling part and the distance moved by the moving block?

Q2. If there are four parts of the line emerging from the moving block, what is the VR?

Q3. What is the hauling part distance required to move a load 20 m, with a tackle that has a VR of two?

ANTICIPATED ANSWERS

A1. Velocity ratio.

A2. Four.

A3. 40 m.

END OF LESSON CONFIRMATION

Have cadets complete the handout located at Annex B.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

The ability to identify the components of a tackle will assist in completing ropework tasks more efficiently with minimal effort. Understanding the concepts surrounding tackles will provide the knowledge to maximize the use of these tackles.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C1-003 (ISBN II 770973 5) Royal Navy. (1972). *Admiralty Manual of Seamanship 1964* (Vol. 1). London, England: Her Majesty's Stationery Office.

C1-047 (ISBN 0 11 772695 8) B-ON-050-002/PT-004 Command of the Defence Council. (1995). *BR 67 Admiralty Manual of Seamanship*. London, England: HMSO Publications Centre.

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TACKLE LABELS

STANDING BLOCK

RUNNING PART

STANDING PART

HAULING PART

MOVING BLOCK

LOAD

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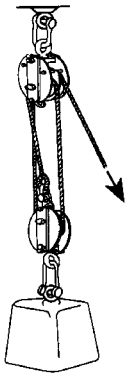
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TACKLES REVIEW

1. What type of blocks make up a luff tackle? _____.

2. What type of blocks make up a two-fold purchase? _____.

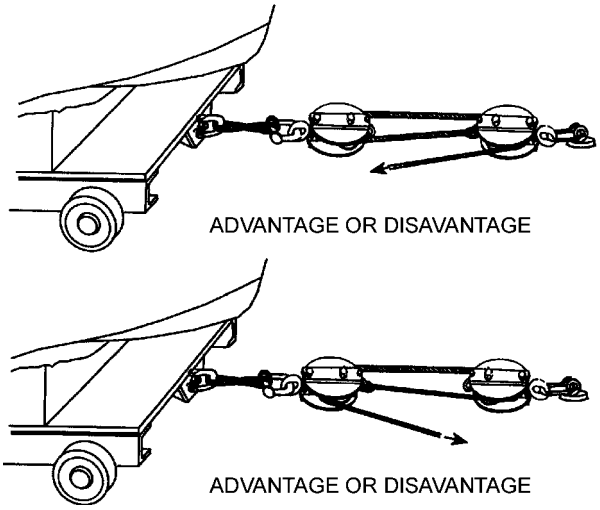
3. What is the following tackle called? _____.



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Figure B-1 Tackle

4. Identify the tackle rigged to advantage/disadvantage? Circle the appropriate answer:



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Figure B-2 Advantage or Disadvantage

5. What is the mechanical advantage (MA) of a luff when rigged to:

   a. disadvantage _____.

   b. advantage _____.

6. If you want to lift a load of 200 kg using a two-fold purchase rigged to advantage, what would be the weight felt by the hauling part? _____.

7. If you want to raise a load a distance of four metres using a double whip rigged to disadvantage, what would be the required hauling distance? _____.

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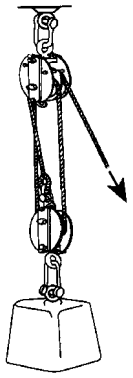
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TACKLES REVIEW – ANSWER KEY

1. What type of blocks make up a luff tackle? *One single block and one double block*.

2. What type of blocks make up a two-fold purchase? *Two double blocks*.

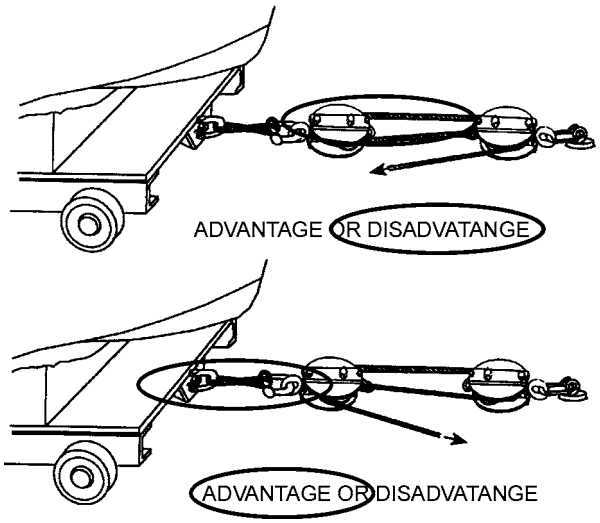
3. What is the following tackle called? *A luff*.



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Figure C-1 Tackle

4. Identify the tackle rigged to advantage/disadvantage? Circle the appropriate answer:



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Figure C-2 Advantage or Disadvantage

5. What is the mechanical advantage (MA) of a luff when rigged to:

   a. disadvantage *Two*.

   b. advantage *Three*.

6. If you want to lift a load of 200 kg using a two-fold purchase rigged to advantage, what would be the weight felt by the hauling part? *Forty kilograms*.

7. If you want to raise a load a distance of four metres using a double whip rigged to disadvantage, what would be the required hauling distance? *Eight metres*.

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