KNACK™

MAKE IT EASY

KNOTS YOU NEED

Step-by-Step Instructions for More Than 100 of the Best Sailing, Fishing, Climbing, Camping, and Decorative Knots

BUCK TILTON

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BUCK TILTON

WITH PHOTOGRAPHS BY BOB HEDE

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Guilford, Connecticut

An imprint of The Globe Pequot Press

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Text design by Paul Beatrice

Library of Congress Cataloging-in-Publication Data is available on file.

ISBN 978-1-59921-395-8

Printed in China

10 9 8 7 6 5 4 3 2 1

For my wife, Kathleen Hart Tilton, to whom the best knot of all is tied.

Acknowledgments

As thousands of authors have truthfully acknowledged in the past, a book is rarely, if ever, the result of one individual's effort. This author recognizes knotmasters of the past, especially Clifford Ashley and Dr. Harry Asher, and knotmasters of the present, especially Geoffrey Budworth and Peter Owen. He also recognizes the publishing team at The Globe Pequot Press, especially Maureen Graney and Katie Benoit. Thank you all so much.

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INTRODUCTION

Long before mallet and peg, hammer and nail, glue, adhesive tape, or Velcro, there was cordage—and the knots that made it useful. Beside the unknown inventor of the wheel and the forgotten discoverer of fire-making, we should rank equally as a genius the man or woman who figured out how to entangle the ends of vines and plants' fibers in ways that would keep them from untangling.

The tying of the first knot may have occurred more than 100,000 years ago. How else were prehistoric stone ax heads attached to prehistoric axe handles? No evidence, however, remains. But off the coast of Denmark, a fish hook was found still tied to a line (a length of sinew or gut) with what we know today as a clove hitch (see page 36). This hook-and-line was estimated to exceed 10,000 years in age. Part of a knotted fishing net retrieved from a bog in Finland has been dated circa 7200 BC. During the peaks of their civilizations, the Egyptians, Greeks, and Romans tied complex knots for diverse jobs—and left wonders that remain thousands of years later. From the icebound polar regions to the ever-warm equatorial regions, all cultures in all times have knotted cords.

Over the centuries, knots were used by builders, surveyors, soldiers, and sorcerers. The butcher, the miller, the cobbler, the farmer, the weaver, the housewife—they all needed a knot or two, or three. Knots were used for communication, for record-keeping, in religious rites, and for corporal punishment. It was at sea, though, under sail, that the science and art of knot-tying blossomed. As the scope and practice of ships at sea expanded, so did the knots—in both form and function—which made their undertakings possible. Still, it should be remembered, as Geoffrey Budworth writes in *The Illustrated Encyclopedia of Knots:* "For every knot tied aboard ship throughout the last millennium, another was tied ashore."

An exhaustive compendium of knots would be a weighty tome indeed, including today more than 4,000 recognized ways of acceptably entangling cordage. And that number does not include the variations possible with many knots. This book, of course, in no way pretends to be "complete" in the exhaustive sense. It does include 110 knots (yes, one hundred and ten)—more than enough to get every job done. Do you need to know them all? If not, which knots should you know?

The International Guild of Knot Tyers (IGKT), founded in the United Kingdom in 1982, published in June of 1999 from their Surrey branch a list of six knots they think should be known first for use with modern rope. These are the figure 8 knot (see page 22), sheet bend (see page

26), bowline (see page 62), rolling hitch (see page 80), constrictor knot (see page 85), and the round turn and two half hitches (see page 104). They further suggested the figure 8 might be the best overall knot since it can be modified to serve as a stopper, bend, loop, or hitch.

The "Surrey Six," despite its thoughtful creation, may not meet all of your knot needs. An angler may decide the uni-knot is absolutely essential. A decorative knot tyer could declare life impossible without a lanyard knot. A climber may refuse to clip in at mid-rope to anything except the alpine butterfly.

You will need to explore knots, and tie lots, and choose the one or two that consistently meet the demands you place on them. But you are limited only by your willingness to learn. There are many knots fit to be tied.

Today's knots are most often tied by campers, boaters, climbers, anglers, and artisans. This book is divided into those five categories. But knots themselves do not divide neatly. The overhand knot, for example, falls easily into all five categories, as does the double overhand and the half hitch. The bowline is useful in camping, climbing, and boating. And the fisherman's knot is used by campers and climbers as well as anglers.

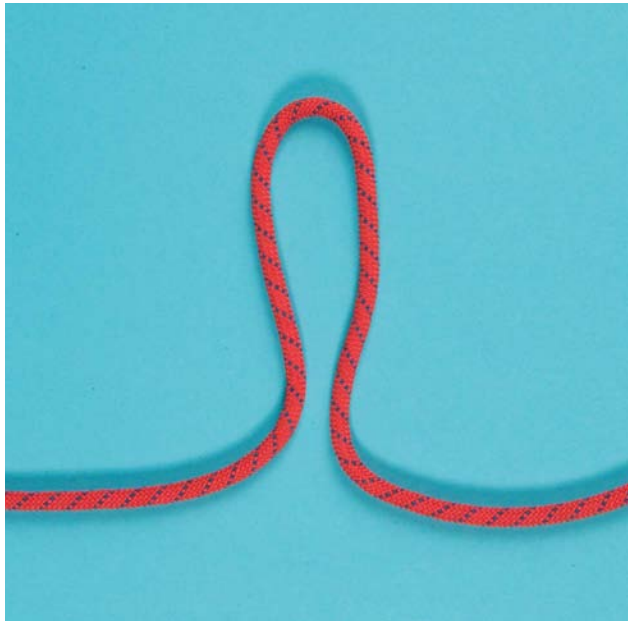
Despite the overlap, campers will find all the knots they need, and more, in the chapters on camping knots, and the same is true for the other categories. However, I encourage you to read the entire book. As a camper, you may find the knot you have always wanted in the boating or climbing chapter. A boater's soon-to-be favorite knot might be found in the fishing chapter. And the quest for the perfect knot or knots is sure to be, as it always has been, an enjoyable journey.

A bowline.

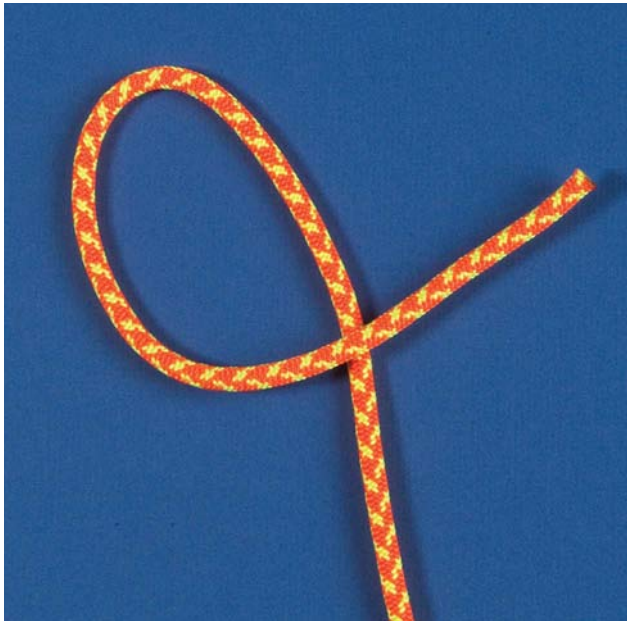
Knot Terminology

The world of knotting has developed specific meanings for certain words and phrases. The end of the rope or cord used to tie a knot is the *working end,* and the other end is the *standing end*. In between the working and standing ends lies the *standing part*. When a section of cordage is doubled into a U shape, a *bight* is formed, and a bight is the first step in many knots. When a section of cordage is doubled and crosses over itself, it becomes a *loop,* another start for numerous knots. Where the rope or cord crosses itself is known as a *crossing point*. When

A bight.



A loop.



the working end is not pulled completely through a knot, a *draw loop* is formed, which turns the working end into a quick-release device. A knot that comes undone or untied may also be said to *spill* or *capsize*. To take a wrap around a post or rail is to *take a turn,* but another half a turn around the post or rail creates a *round turn*.

Knot itself can be a generic term applied to any interlacing of flexible material that involves a tucked end or a bight. But *knot* can also have a more specific definition. It can be what ties two ends of the same line together, such as a bowknot in a shoelace, and *knot* typically re-

A draw loop.

fers to anything tied in small stuff such as twine or string. Fishing knots are almost always called knots, regardless of their form or function.

Speaking of function, a *stopper* is tied into the end of a rope to prevent it from slipping through a slit or hole, or to prevent the end of rope from fraying. Stoppers are sometimes tied as simple backups for more complex knots to keep the complex knots from spilling. A *bend* is a knot that joins two separate ropes or cords together. A *hitch* is used to attach a rope to a post, pile, ring, rail, another line, or even to itself.

Knot Nomenclature

Some knots have survived for ages without officially being named, while others are tagged with an unruly list of names. The fisherman's knot, for example, may also be known as the angler's knot, halibut knot, water knot, waterman's knot, English knot, Englishman's knot, or true lover's knot. Additional names for a knot, furthermore, may be unclear. A double fisherman's knot is sometimes called the grinner knot, but the uni-knot is also sometimes called the grinner knot.

A knot's name may also reflect what it looks like. A figure 8 knot looks like its name, and so does a round turn and two half hitches knot. Some knots are named for their inventors: Ashley's stopper, Matthew Walker knots, the Prusik. Some knots are named for their uses: hangman's noose, constrictor knot, cow hitch. And knot names are often misleading. A fisherman's knot is used as a bend; a fisherman's bend is actually a hitch; a midshipman's hitch is really a loop; and a girth hitch is also known as a ring bend. . . . You get the picture. As a final confusing act, occasionally two different knots will bear the same name. The water knot, when referring to the fisherman's knot, isn't the same knot as the water knot when referring to the climbing knot. In the end, the naming of knots is, for the most part, a rather haphazard affair.

Knot Strength

The *breaking strength* of a rope, determined by the manufacturer, tells how much stress or weight that rope will bear before breaking. *Knot strength* refers to how much the knot reduces the breaking strength of a rope compared to the breaking strength of the same rope unknotted. Any rope or cord is strongest when stressed or loaded in a straight line. Any turn reduces strength, and knots turn, twist, nip, and tuck cordage from gentle curves to sharp angles. Therefore, they vary in strength.

The measurement of knot strength, unfortunately, is far from a precise science. It is generally accepted that the overhand knot (see page 18), perhaps the weakest knot, reduces the breaking strength of a rope by more than one half. So the overhand knot is said to be 45 percent efficient, or, in other words, the overhand knot's strength is 45 percent (which means the breaking strength of the rope is reduced by 55 percent).

A turn with the rope doubled.

It should be remembered that a slow and steady pull challenges a rope's breaking strength far less than a sudden shock-load. Only the strongest knots should be used if a rope might be shock-loaded (such as when a climber falls). Also, remember that a knot tied properly is stronger than a knot tied improperly. Or, as the old adage explains: "A not-neat knot need not be knotted."

With relativity in mind, the figure 8 knot (see page 22), the variations on the figure 8, the clove hitch (see page 36), the double bowline (see page 66), and the round turn and two half hitches (see page 104) are considered very strong knots.The girth hitch (see page 98), the double fisherman's knot (see page 108), and the water knot (see page 110). are strong knots. By comparison, a sheepshank knot (see page 88) should *never* be found in ropes of vital importance.

Be not dismayed, however. Modern synthetic ropes and cords are so incredibly strong that they are not often significantly threatened by knots. This book does address knot strength when it seems applicable.

A round turn.

Knot Security

A strong knot, however, is not necessarily a secure knot. Knot security is a different consideration from knot strength. A knot that can be shaken loose to spill of its own accord, such as the bowline (see page 62), is an insecure knot. A knot that slips gradually due to intermittent stresses, such as the clove hitch (see page 36), is an insecure knot. A knot such as the killick hitch (see page 51) may be insecure when pulled in one direction but secure when pulled in the opposite direction. And a knot that holds well in all conditions and in wet, slimy, slippery rope or cord is a secure knot. The vice versa (see page 56) is an example of a secure *and* strong knot. This book addresses knot security when it seems relevant.

Of Ropes and Cordage: Beginning to End

For a knot to exist, something in which to tie the knot must first exist. Traditionally, if that something is over 10 mm in diameter, it is called *rope*. Ropes for special purposes are called *lines*—stern line, tow line, clothesline. Smaller stuff is often referred to as smaller stuff, an informal title, and includes *cord* (which usually refers to large smaller stuff), and then *twine* or *string* (and perhaps *thread*). The smaller stuff is further set apart by its diameter: 5 mm cord, 6 mm cord, and so forth. None of these terms are sacred. Fishing line, for instance, no matter how remarkably thin, is always called *line*, and the word *cordage* may be used to describe both ropes and cords.

The first cordage came from plant and animal fibers. Flax and jute are made from plant stems. Hemp and manila come from plant leaves, and cotton from seeds. Ropes have been created from coconut shell fibers, grass, wool, silk, and hair from horses, camels, and even humans. Excellent cordage has also been made from leather.

Since natural fibers are limited in length to a maximum of about 3 feet, ropes woven from natural fibers are

A stopper knot.

always relatively weak. They also swell when wet, freeze and crack in extreme cold, provide something interesting for insects and rodents to chew on, and require tedious drying before storing. The ends of the fibers stick out from the surface of the cordage, making them rough on the hands of the handlers. All things considered, the development of synthetic fibers was a glorious advance.

Ropes and cordage today are manufactured almost exclusively from nylon, introduced to the domestic market in 1938, and from other more recently developed synthetic fibers. These fibers run continuously along the length of a rope. In addition to being phenomenally stronger and lighter than natural fibers, synthetics handle easier; last longer; and resist abrasion, rot, and mildew. Some of them (polypropylene ropes, for instance) float as well. Being smooth on the surface, they are also easy on the hands. Important on the list of benefits, synthetic fibers stretch when the load is applied, sometimes up to 40 percent, and return to their original length when the load is off. And synthetics can be made in a wide range of colors, from subtle to brilliant. When ropes are arranged close together yet do different jobs, as happens sometimes in climbing, different colors make life easier as well as safer.

Synthetics do have their negative aspects, though. They melt if high heat is applied. Even high friction-generated heat will harden the surface of a synthetic rope, making it less functional. Knots tend to stay tied in "hairy" ropes of natural fibers, but knots tied in synthetics tend to fall apart more often due to the smoothness of the ropes. This has led to the use of backup knots (simpler knots preventing more complex knots from slipping) and the evolution of new knots that are more secure in synthetics.

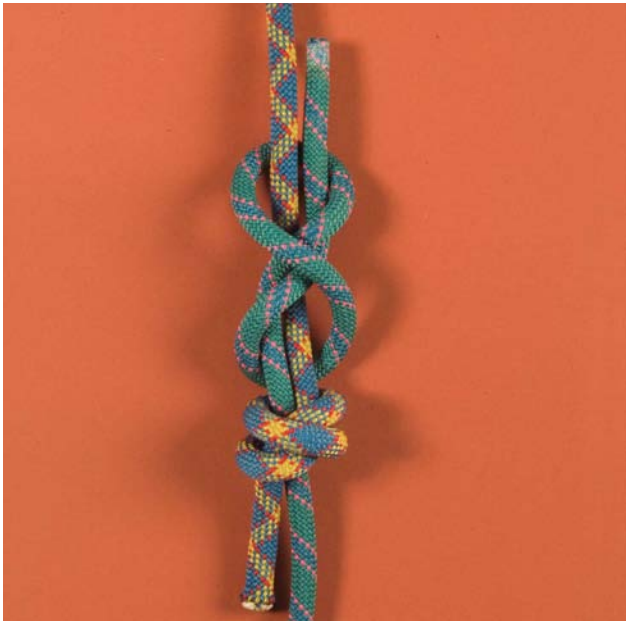
The making of most synthetic cordage begins with long monofilaments, although sometimes multifilaments (a cluster of very thin fibers) are used. Batches of the filaments are spun together clockwise to make long yarns.

To make a *laid rope* (laid in strands), a batch of the clockwise-spun yarns are spun together counter-clockwise

to make a strand. When the required size of strand is reached, three strands are spun together, clockwise again this time, to make the traditional three-stranded rope. It is all the spinning and counter-spinning during the manufacturing process that causes the strands of a rope to cling tightly together.

More often synthetic cordage is braided rather than laid. Most braided ropes are made of two layers, a sheath and a core. The sheath consists of interwoven yarns that protectively enclose the core. The core yarns often run parallel to the length of the rope but may be laid or even plaited (interwoven) if a very large and strong rope is needed. (This sheath-and-core construction is typically called *kernmantle* by climbers.) Occasionally, braided ropes consist of three layers: outer sheath, inner sheath, and core.

A double fisherman's knot.



All cordage, whether laid or braided, may be manufactured with the fibers under high tension and called hard-laid, or made with the fibers under less tension and known as soft-laid. Hard-laid ropes are more durable but also more stiff, especially when new.

A critical aspect of managing rope, no matter what material it is made of, concerns the ends. When the ends are cut, the rope gradually falls apart. Synthetics, lacking the inner cohesiveness of the fibers, fall apart faster than natural fiber ropes. The answer: Do not cut any cordage without first taking steps to prevent unraveling and fraying. There are numerous ways to accomplish this.

Whipping (see page 94) and splicing (see page 90) were once commonly used and still work. *Liquid whipping*, a manufactured product into which rope ends are dipped, is also available. Three-stranded rope ends can be temporarily protected with a constrictor knot (see page 85) tied in twine around the end, or with tape. With synthetic cordage, cutting with a heated knife heat-seals the cut ends. Heat-sealed ends that will see hard use are best backed up with tape or another method of protection against deconstruction.

A bend.

A zeppelin bend.

One thing, by the way, that natural fiber cordage and synthetic fiber cordage have in common is this: High quality products are expensive.

Knot-Tying Tips

Choose the simplest knot that will get the job done. It will be easiest to learn, easiest to remember, quickest to tie, and usually the easiest to untie.

Study and practice in order to tie all knots correctly. Many knots can be tied more than one way. The route seldom matters, but the final configuration is of the utmost importance. A tuck in the wrong direction, for instance, turns a square (reef) knot into an indefensible granny knot.

Knots can be tied right-handed or left-handed, depending on the dominant hand of the tyer. A knot tied right-handed will be the mirror image of the same knot tied left-handed. A few knots have a right-handed element and a left-handed element.

A properly tied knot must be properly tightened. Most

knots must be slowly tightened—shaped, kneaded, molded—into proper configuration, which almost always means there are no gaps in the knot. It is rarely a matter of tugging on the working and standing ends.

Choose the best cordage for the job. A knot works only as well as the rope or cord. Highly elastic cords, such as bungees, shed a bowline (see page 62), but a vice versa (see page 56) holds securely. It is, in other words, not only a matter of the right knot but also the right material to tie it in.

A hitch.

Disclaimers

In order to achieve the maximum photographic effect, the text may refer to one type of cord or line while the photographs show another. The majority of these apparent contradictions occur in the fishing knot chapters, where the knot may be excellent for fine monofilament but it is photographed in heavy fly line. This is because photos of fine monofilament fail to adequately reveal the steps in tying the knots. Trust the text for information, and trust the photo sequences for the proper knot-tying steps.

It is suggested in several places in this book that a specific knot will work, if tied correctly, to save or help save a life. This occurs almost exclusively in the climbing knot chapters. The use of knots in this book to save or help save a life, however, should only be undertaken by people qualified to use the knots appropriately. This is not a how-to book for activities other than the tying of knots themselves.

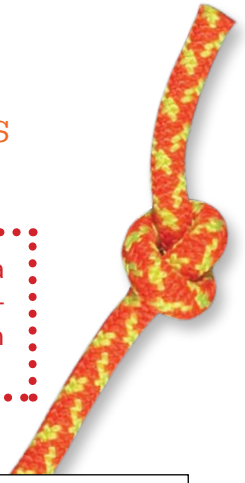
OVERHAND KNOT

A simple and useful stopper knot that also forms the basis for many intricate knots.

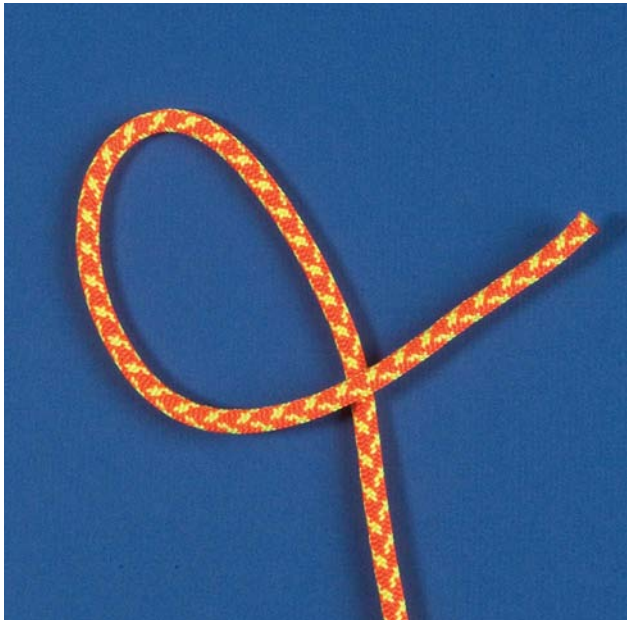
As the most fundamental knot, the overhand stands alone as the knot first learned, often by accident, by anyone who handles rope or cordage of any type. A small stopper, it may not meet the demands of all situations. The overhand is repeated time and time again as part of other knots.

RED LIGHT

This knot reduces the strength of a rope by as much as 55 percent. Remove unwanted overhands from mid-rope as soon as possible.



Overhand Knot: Step 1



Create a loop in the working end of a rope or cord.

GREEN LIGHT

The overhand is useful in boating, climbing, fishing, and craftwork.

Overhand Knot: Step 2

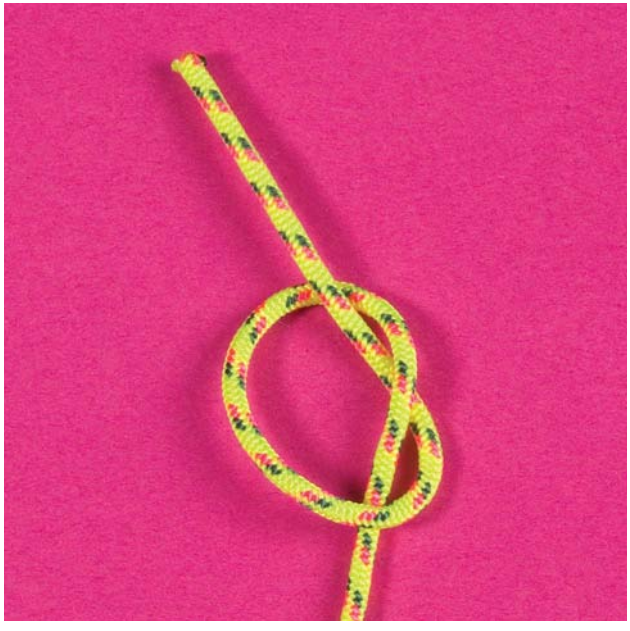
Take the working end over the standing part and back up through the loop. Tighten the knot by pulling simultaneously on the working end and the standing end.

OVERHAND KNOT WITH DRAW LOOP

A variation of the overhand knot that is slightly larger and much easier to untie.

When a basic overhand knot is tightened over a loop, the loop may be drawn out with relative ease by holding the knot and pulling on the working end. This makes the overhand knot with draw loop a better choice than the basic overhand when the knot will be untied soon or often.

Knot with Draw Loop: Step 1

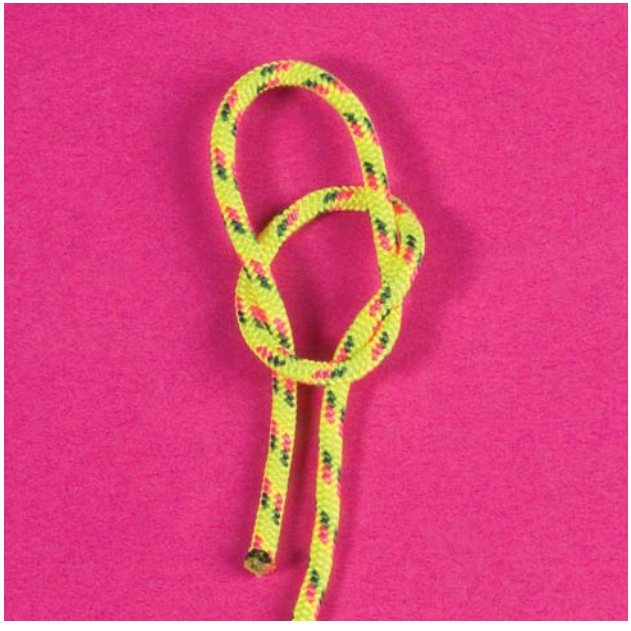


Tie an overhand knot (see page 18) in the working end of a rope or cord.

GREEN LIGHT

This knot is useful in boating, climbing, and fishing.

Knot with Draw Loop: Step 2



Before tightening the knot, take the working end back through the overhand. Tighten the knot by pulling on the loop and the standing part.

HEAVING LINE KNOT

A large stopper knot that adds considerable weight to the end of a rope.

The weight of the heaving line knot makes it useful for throwing the end of a rope over a greater distance. Tossing the end of a rope intended for hanging a bear bag over the limb of a tree, for instance, is easier with this knot. When a heavy rope needs to be strung across a gap, the heaving line knot can be tied in the end of a lighter line, which in turn is then tied to the heavier line. The lighter line is thrown more easily over the gap, and the heavier line then is drawn (or heaved) behind it. When sailors needed to toss a rope between ship and

Heaving Line Knot: Step 1

Form a loop in the working end of a rope. Bring the working end over the standing part and back under the loop.

Heaving Line Knot: Step 2

Bring the working end back over the loop, compressing the loop.

dock, the heaving line knot worked well. Its other name, the monk's knot, refers to its use by Franciscan monks to weight the ends of the cords they used as belts. In addition to being useful in camping and boating, the heaving line knot is sometimes employed by climbers.

Heaving Line Knot: Step 3

Make three more turns with the working end around the loop.

As the turns tighten, form the knot into its final shape.

Heaving Line Knot: Step 4

After the final turn, bring the working end through the loop, holding the turns around the loop as tight as possible. Tighten the knot by pulling on the working end and the standing part.