How Much Yarn Do I Need? A Mathematical Approach

Lori Gayle

Suppose you have a fabulous idea for an original sweater. You've studied instructions for similar garments, covered scraps of paper with sketches and notes, and you're confident that you can figure out how to knit your dream project. One question remains: how much yarn to buy? Depending on your personality, you may want to wing it—take an educated guess and cross your fingers—or you may want to do some swatching and figuring and come up with a careful and, likely, accurate estimate.

Winging It

If you want to wing it, consider referring to one of the many reference guides that give yarn requirements based on garment size and yarn thickness, but keep in mind that the information in them is intended to be used only as a general rule of thumb. Alternatively, purchase yarn according to amounts given for a similar sweater in a published pattern, if you trust that the yarn amounts there are correct. To arrive at a more dependable estimate based on the details of your particular project, apply the easy-to-follow mathematical formulas here.

Using Your Math

To estimate yarn needs accurately you need to determine how many ounces/grams or yards/meters of the chosen yarn are required to produce a piece of knitted fabric of a certain size. Then you need to determine the sizes of all your garment pieces.

The following example walks you through the estimation of yarn required for a solid-color child's pullover worked in one stitch pattern. Strategies for estimating yarn amounts for multicolored and/or textured projects begin on pages 73 and 75, respectively.

Step One: Knit a Swatch

Like many other knitting adventures, the first step in determining yarn needs involves making a swatch, for which you will need at least a single skein of your chosen yarn. You can use the same swatch to determine gauge.

Knit a generous swatch—at least 5" (12.7 cm) square. Let's assume for our example that the gauge of your stitch pattern works out perfectly to 20 stitches and 28 rows in 4" (10 cm). If you cast on 25 stitches and make a 5" (12.7 cm) square swatch, you will have a piece of fabric knitted in your pattern stitch that covers 25 square inches (161.3 square cm). You now need to discover either the weight of the swatch or the length of yarn used in it.

Swatch Weight Method For this method, a digital scale or triple-beam balance is ideal, but postal or kitchen scales, which measure in fractions of grams/ounces, will also work well. Check the yarn label for the weight of the ball of yarn. You'll save yourself an extra step later on if you work with the same system reported on the yarn label—grams or ounces. Let's say that the yarn for our example project contains 109 yards (100 meters) in each 50-gram skein. Therefore, you'll want to find out the weight of the swatch in grams.

For our example, let's suppose that the swatch weighs 10 grams. (If you weighed your swatch in ounces, multiply the number of ounces by 28.35 to get grams.) You can now determine the weight of yarn in each square unit of knitted fabric:

10 grams ÷ 25 square inches = 0.4 grams per square inch
(10 grams ÷ 161.3 square cm = 0.06 grams per square cm)

Swatch Length Method This method is based on the length of yarn required to knit the swatch. Unravel the swatch (after measuring it, of course). If necessary, stretch the unraveled yarn slightly to straighten out any kinks (but avoid pulling it tight, especially very elastic yarns, or you will get an artificially long result) and use a yardstick (or yardage counter, spinner's niddy-noddy, or weaver's warping board) to measure the total length. Let's say that the yarn from the unraveled swatch measures 21.8 yards (19.9 meters). You can now determine the length of yarn in each square unit of knitted fabric:

21.8 yards ÷ 25 square inches = 0.87 yards per square inch
(19.9 meters ÷ 161.3 square centimeters = 0.12 meters per square centimeter)

Step Two: Draw a Schematic

The next step is to determine how many square inches or centimeters there are in the entire garment by drawing a schematic. Here's a quick technique for getting a good estimate. If your algebra skills are still sharp, feel free to use a more exact method.

Draw a sketch of all the garment pieces laid out as if you were going to cut them out of imaginary rectangles of fabric. Remember to include elements not typically shown on schematics like neckbands, button bands, armhole bands, collars, pockets, and facings. The illustration on page 73 shows the pieces of our project arranged on three rectangles. *Note:* If you're planning to work your project in the round, still draw the pieces as if they had been cut apart like the ones in the example.

The back and front fit into a rectangle that measures 16" × 30" (40.5 × 76 cm), or 480 square inches (3078 square cm). The

sleeves fit into another rectangle (one sleeve is drawn upside-down to nestle close to its mate) that measures 11" × 23" (28 cm × 58.5 cm), or 253 square inches (1638 square cm). The shaded areas in the rectangle, which represent areas of no knitting, allow for an extra "fudge factor" in the estimate. The neckband is shown on the third rectangle, measuring 1" × 18" (2.5 cm × 46 cm), or 18 square inches (115 square cm). In our sample, the neckband is 1" (2.5 cm) deep and we've given a generous estimate for the length of twice the back neck width plus twice the front neck depth.

Step Three: Add it All Together

The next step is to add the areas of the three rectangles. Our sample sweater will require about 751 square inches (4831 square cm) of knitted fabric. Remember that the yarn chosen for this project contains 109 yards (100 cm) in each 50-gram skein.

If you used the *Swatch Weight Method*, you know that each square inch weighs 0.4 grams, and each square centimeter weighs 0.062 grams. Multiplying these weights by the total area required gives you the total weight of yarn required:

751 square inches × 0.4 grams per square inch = 300.4 grams

(4831 square cm × 0.06 grams per square cm = 289.9 grams)

Each of these estimates requires approximately six 50-gram skeins.

If you used the *Swatch Length Method*, you know that each square inch takes 0.87 yards of yarn, and each square centimeter takes 0.12 meters. Multiplying these lengths by the total area required gives you the total length of yarn required:

751 square inches × 0.87 yards per square inch = 653.4 yards

(4831 square cm × 0.12 meters per square cm = 579.7 meters)

Each of these estimates requires approximately six 109-yard (100-m) skeins.

The slight differences between the answers are the result of rounding the numbers up or down. It is always a good idea to add an additional 10% safety margin to cover any minor errors in weighing or measuring, and to accommodate design changes that may occur as you knit the garment. In this case, an extra 10% would bring the estimate to 6.6 skeins, or a purchase of 7 skeins.

Strategies for Multicolored Garments

Stripes For a striped garment (with the colors used in equal amounts), you can divide the total yarn requirement by the number of colors. The pullover in our example requires about 6 skeins before adding the 10 percent safety margin. If you worked a stripe sequence of 4 rows each of colors A, B, C, and D repeated over and over, you would need about 1½ skeins of each color (6 ÷ 4 = 1.5), or a purchase of 2 skeins of each, with a comfortable safety margin.

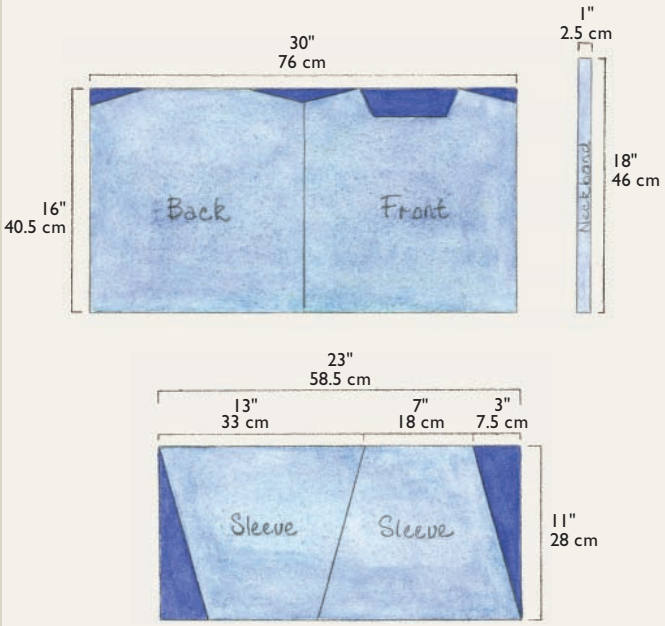
If you want the colors to be unevenly represented, you'll need to determine the number of rows of each color in one repeat of the sequence. Let's say you want to use the following 20-row stripe pattern: 2 rows purple, 1 lilac, 2 purple, 1 red, 1 purple, 1 lilac, 1 navy, 2 turquoise, 1 lilac, 2 red, 1 navy, 2 red, 1 purple, 2 lilac. Each 20-row sequence has 6 purple, 5 lilac, 5 red, 2 navy, and 2 turquoise rows. Determine the yarn requirements as follows:

Step 1 Divide the number of rows for each color by the total number of rows to get the percent represented by each color: 30% purple (6 ÷ 20 = 0.30), 25% lilac, 25% red, 10% navy, 10% turquoise.

Step 2 Multiply the percentage times the total number of skeins required. In this example requiring 6 skeins you would need the following: 1.8 purple (30% x 6), 1.5 lilac, 1.5 red, 0.6 navy, and 0.6 turquoise. Therefore, you would need 2 skeins each of purple, lilac, and red, and 1 skein each of navy and turquoise.

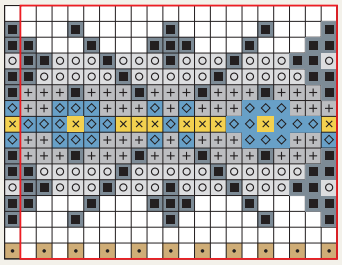
Weaving in the ends will use up a little extra yarn, so if the amount for any color is close to a full skein, consider rounding up to the next skein. If one color is to be used exclusively for ribbing or some other edge finish, it may require an extra skein as well.

Drawing a Schematic to Estimate Yarn Needs



Drawing a schematic this way allows you to determine how many square inches or centimeters there are in an entire garment.

Estimating Yarn Needs for Stranded Colorwork



To estimate yarn needs for a project done in stranded colorwork, knit a swatch containing one or more full repeats, then calculate the percentage represented by each color. (Chart from Caramel-Denim Fair Isle, Knits, *Fall 2001.)*

Stranded Colorwork Prepare a swatch 5" (12.7 cm) square or larger that contains one or more full repeats of the intended colorwork pattern. Do not work any partial repeats because the color proportions might be misrepresented.

Weigh or measure the swatch to determine the amount of yarn required for each square inch or square centimeter of knitted fabric and apply the methods outlined in *Step Three: Add it All Together* to determine the total number of skeins required for your garment. Because the unused colors float along the back of the work, stranded colorwork swatches are heavier than their stockinette counterparts, so you can expect such a sweater to use more yarn. Let's assume we want to knit the same size child's pullover as in our previous example, but we want to use the colorwork pattern shown on the chart above. Let's also assume that the

weight of our colorwork swatch tells us that we'll need a total of 8 skeins of yarn.

To determine the amount of yarn required for each color, add up the number of stitches in one full pattern repeat, ignoring any pattern-balancing stitches outside the repeat box. In our chart, there are 320 stitches inside the red repeat box (20 stitches x 16 rows): 212 ecru background, 10 brown, 58 black, 2 light gray, 9 gold, and 29 blue. Use steps similar to those in the *Stripes* section to calculate the percentage represented by each color.

Step 1 Divide the number of stitches for each color by the total number of stitches to get the percentage of the pattern represented by each color: 66% ecru (212 ÷ 320 = 0.66), 3% brown, 18% black, 1% light gray, 3% gold, and 9% blue.

Step 2 Multiply the percentage by the total number of skeins required. For our example, which requires 8 skeins total, this means 5.28 ecru (0.66 × 8), 0.24 brown, 1.44 black, 0.08 light gray, 0.24 gold, 0.72 blue. You'll need 6 skeins ecru, 2 skeins black, and 1 skein each brown, light gray, gold, and blue.

Be aware that colors that appear infrequently may actually use a disproportionate amount of yarn if their floats are very long, like the gray color in Rows 5 and 13 of our chart. In this example the estimate for light gray is so much less than one skein that a single skein will be enough to accommodate the floats. When in doubt, however, purchase an additional skein. Also remember that extra yarn will be required for weaving in ends, so if the amount for any color is close to a full skein, consider rounding up by one. If one color is to be used exclusively for ribbing or some other edge finish, it may require an extra skein as well.

Intarsia Determining color proportions for an intarsia garment can be tricky because color areas are often irregular and the design may require only small amounts of many colors. If your garment is mostly stockinette, use the method described for our sample sweater to get a rough idea of how much yarn you will need overall. If the design has a lot of textured areas, consider making a separate swatch in the textured stitch to see if it consumes more yarn than stockinette, and then plan accordingly.

Here is a rather unscientific method for arriving at a rough estimate for intarsia color proportions. Draw a schematic of the garment pieces and sketch the intarsia design to scale as it will appear on them. Be sure to include any pieces that will be knitted in a solid color. Depending on the size of the sketch, use the eraser end of a pencil, coins, the bottom of a glass, or even your hand as a measuring unit. Take a rough count of how many units it takes to cover the entire garment.

Let's pretend that you are knitting the child's pullover in the previous example (which requires 6 skeins of a solid color) with a multicolored beach scene. After making a small to-scale drawing of the major design elements and raiding the piggy bank, it turns out that sketches of the garment pieces can be covered by 50 pennies, with a little bit peeking out around the edges. Count the pennies as you remove them from each color area, and round up any fractions of a penny. Pretend that our imaginary beach sweater has 16 pennies' worth of sky blue, 12 sand beige, 5 cloud white, 3 each of two colors for toys, and 4 each of three other colors for the umbrella and shells. Apply steps similar to those used for standard colorwork to determine color proportions.

Step 1 Divide the number of units for each color by the total number of units to get the percentage of the pattern represented by each color: 32% sky blue (16 ÷ 50 = 0.32), 24% sand beige, 10% cloud white, 8% each of three colors, and 6% each of two colors. Sometimes you may find that the totals do not add up to 100% because of rounding, but if they are within a percent or two of 100%, they will be sufficient for estimating. In this case we have 102%, which is acceptable.

Step 2 Multiply the percentage times the total number of skeins required. In our sample garment which requires 6 skeins of a single color, we would need the following: 1.92 sky blue (0.32 × 6), 1.44 sand beige, 0.6 cloud white, 0.48 each for three of the colors, and 0.36 each for two of the colors. Because the amount required for the blue is very close to 2 skeins, round up to the next skein. Therefore, we should purchase 3 skeins sky blue, 2 sand beige, and 1 each of cloud white and the other five colors.

As with stripes, intarsia knitting uses up a little extra yarn for joining and ends, so bear this characteristic in mind for your calculations. Don't forget to add an extra skein or two for any color that will be used for edges or trim.

Strategies for Garments with Multiple Stitch Patterns

When estimating yarn amounts for a solid-color project that uses more than one stitch pattern (like a traditional Aran with several different cables and filler stitches), you have several choices for swatch preparation.

The quickest method is to select the most dense, yarn-eating pattern in the project and knit the sample swatch entirely in that stitch. Usually this will be the pattern with the most cable crossings because a fabric with lots of cables has many places where it is more than one layer thick and the flat plane of the knitting is transformed into a three-dimensional surface.

If you are working with knit and purl stitch patterns, the densest pattern will be the one with the most changes from knit to purl and back again, like seed stitch. Lace stitches are generally less dense than stockinette stitch, especially when they are intended to be blocked significantly. The downside to choosing the most yarn-consuming stitch for swatch preparation is that your yarn estimate is likely to be on the high side, and you may end up with a lot of leftover yarn.

If your garment combines roughly equivalent areas of light, medium, and heavy patterning, you could prepare two sample swatches, one each of the most and least dense patterns, and take an average of the two for calculating the yarn amount. This method may provide a more accurate estimate than the one above. However, its success is dependent on the stitch patterns being evenly divided between the different categories, which may not be easy to determine for a garment in the planning stage.

For the truly diehard approach, you can sample each pattern individually to work out how much yarn it uses, and then figure out what percentage of the garment will be covered by each. This is math-intensive but gives the most accurate estimate.

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