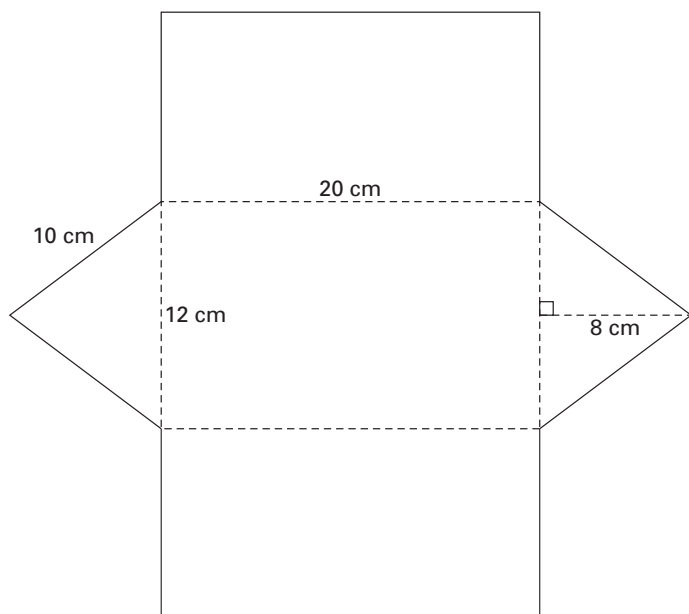


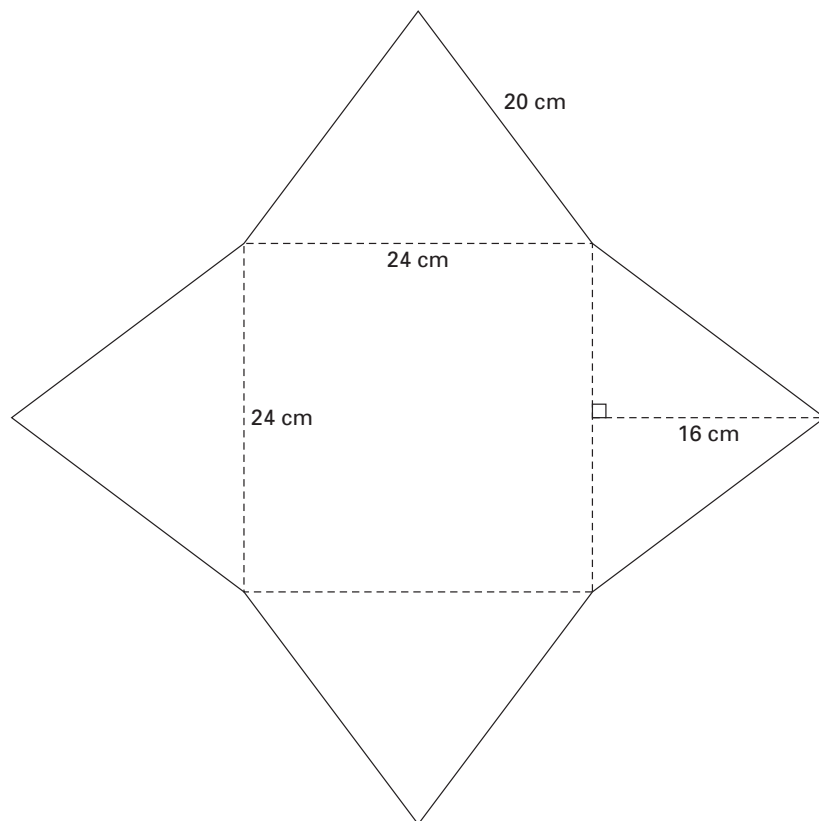
## Appendix A

### Nets for Lunch Containers

a)

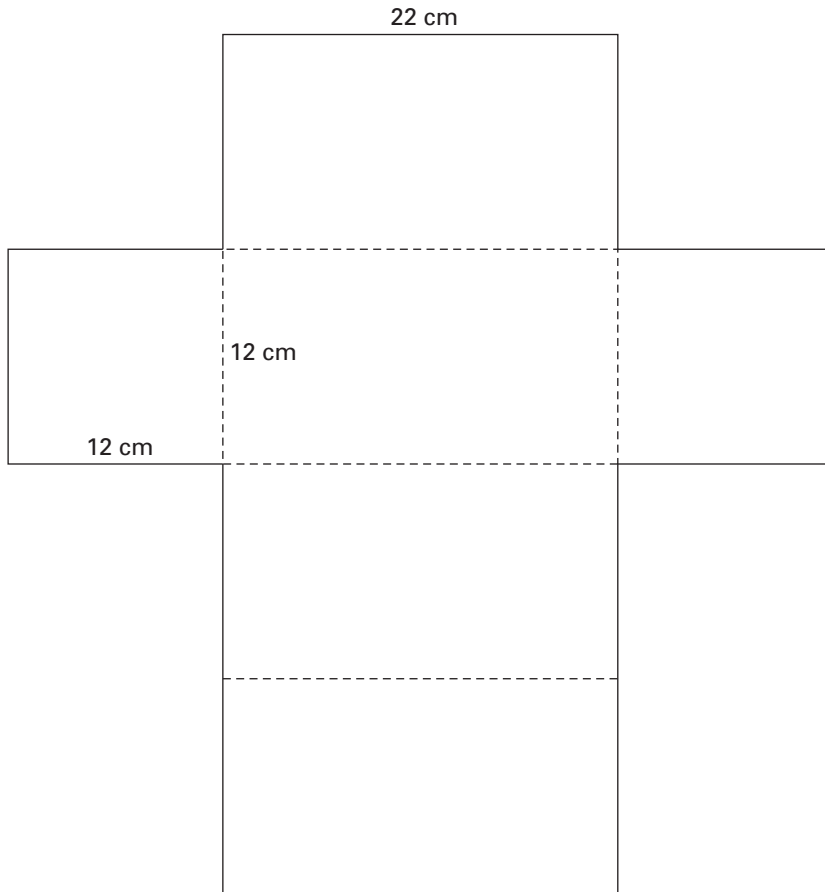


b)



Name: \_\_\_\_\_ Date: \_\_\_\_\_

c)



Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Appendix B

### Menu and Nutritional Information

<b>Bread</b>	<b>Calories</b>	<b>Total Fat Content (grams)</b>
Whole-wheat	138	1.8
White	160	2.0
<b>Meat</b>		
Turkey	45	0.7
Ham	92	4.8
<b>Cheese</b>		
Provolone	94	6.9
Cheddar	114	9.4
Swiss	108	7.9
<b>Sides</b>		
Garden salad	30	0.3
Yogurt	100	0.0
Tomato soup	90	0.0

# Teaching Notes: Fun with Food

## Components

- *Application Question: Lunch Containers*
  - To develop Competency 2: Uses mathematical reasoning
  - To develop Competency 3: Communicates by using mathematical language
  - Can be used after completing *Nelson Mathematics Secondary Year One, Cycle One* Chapters 10 and 11
- *Situational Problem: Geometric Nutrition*
  - To develop Competency 1: Solves a situational problem
  - Can be used after completing *Nelson Mathematics Secondary Year One, Cycle One* Chapters 9, 10, 11, and 12

## Broad Area of Learning: Health and Well-Being; Personal and Career Planning

### Educational Aim

- To teach students to communicate using mathematical language to analyze or present information, in order to exercise critical judgment and share information and points of view
- Contribute to students' personal growth by enabling them to carry out plans when solving situational problems

### Focus of Development

- To encourage students to use their mathematical knowledge to interpret different messages related to development of healthy lifestyle habits
- To enable students to solve situational problems, making them more aware of their identity and potential

## Cross-Curricular Competencies

- Solves problems
- Exercises critical judgment
- Cooperates with others

## Concepts

*Arithmetic: Number Sense With Regard to Decimal and Fractional Notation and Operation Sense*

– Fractional, decimal and exponential (integral exponent) notation; percentage, square root

*Geometry: Geometric Figures and Spatial Sense*

– Solids

- Right prisms, right pyramids and right cylinders
- Possible nets of a solid

## Processes

*Arithmetic: Operations Involving Numbers Written in Decimal and Fractional Notation*

– Written computation: the four operations involving numbers that are easy to work with (including large numbers) and sequences of simple operations performed in the proper order (numbers written in decimal notation), using equivalent ways of writing numbers and the properties of operations

*Probability: Processing Data from Random Experiments*

– Enumerating possibilities using different types of representations: tree diagram, network, table, etc.

*Geometry*

– Finding unknown measurements

- Areas
  - Lateral or total area of right prisms, right cylinders, and right pyramids

## Application Question: Lunch Containers

<b>Preparation and Planning</b>	
Pacing	5–10 min Introduction 30–45 min Cooperative work (pairs)
Materials	<ul style="list-style-type: none"> <li>• a ruler</li> <li>• a calculator</li> </ul>
Masters	<ul style="list-style-type: none"> <li>• Lunch Containers</li> <li>• Appendix A: <i>Nets for Lunch Containers</i></li> </ul>
Can be done after completing	<i>Nelson Mathematics Secondary Year One, Cycle One</i> Chapters 10 and 11

### Introduction (Whole Class) 5–10 min

Discuss with students some of the characteristics of various 2-dimensional and 3-dimensional shapes. Review the definition of “net” and discuss how a net relates to the 3-dimensional shape created from it.

### Using the Application Question (Cooperative Work (pairs)) 30–45 min

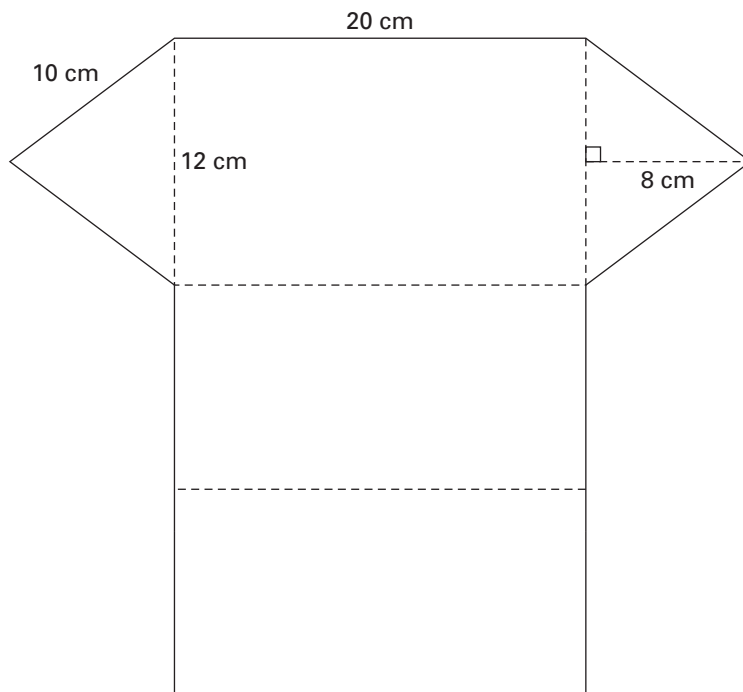
Together, read the introduction, central question, and criteria for *Lunch Containers*. Remind students to use the Evaluation Criteria Checklist to help them complete the activity. Allow students time to work in assigned pairs to sketch the new nets for each of the 3-dimensional shapes.

If students are having difficulty . . .	What you can do to help
Students may have difficulty drawing a new net to represent the 3-dimensional shape.	<ul style="list-style-type: none"> <li>• Suggest that students cut out the nets, fold them into the 3-dimensional shapes, and then cut along one of the fold lines before unfolding to produce a new net. Offer tape to students so that their 3-dimensional shapes will not come undone before they have a chance to cut along one of the other fold lines.</li> </ul>

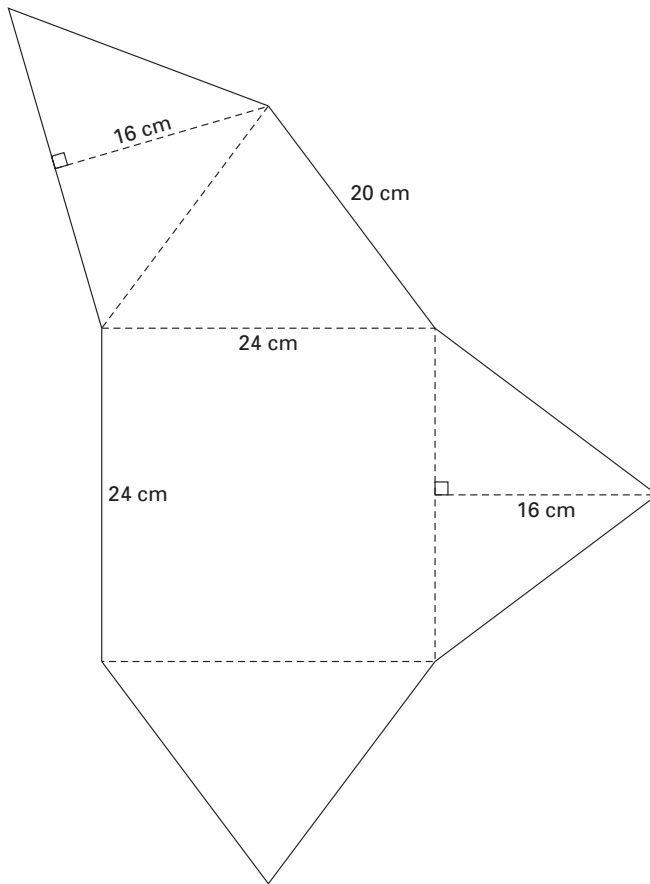
### Sample Solution (Thorough)

A. The turkey and cheese would go with net a). The chicken salad would go with net b), while the BLT would go with net c).

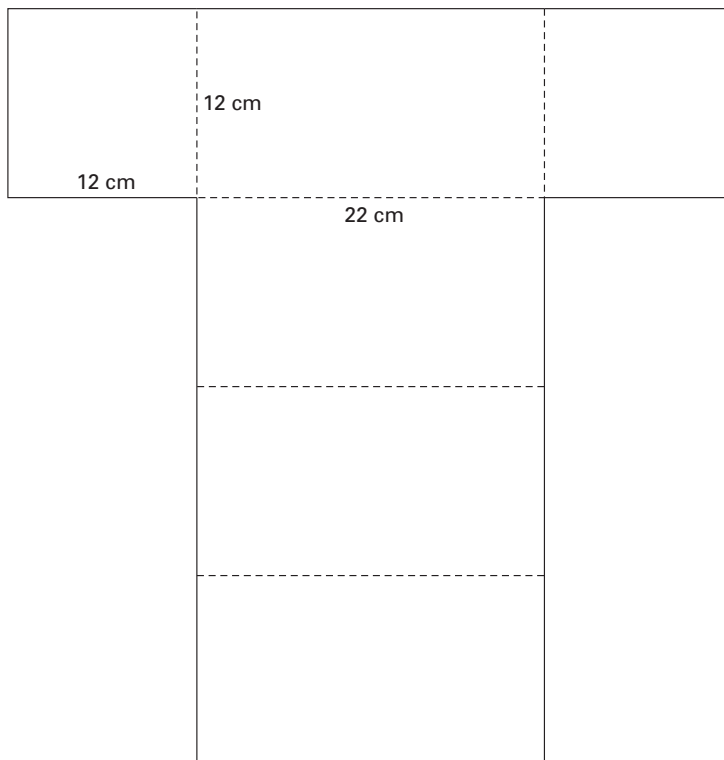
a)



b)



c)



**B.** I used formulas to calculate the area of each of the polygons that form the nets. Then I added these areas together to determine the surface area of the 3-dimensional shapes that the nets represent. Net a) has an area of  $736 \text{ cm}^2$ . Net b) has an area of  $1344 \text{ cm}^2$ . And net c) has an area of  $1344 \text{ cm}^2$ . So net a) goes with the turkey and cheese sandwich lunch. Nets b) and c) have the same area, so either one could go with the BLT, but the two nets represent solids that have different numbers of faces; net b) has five faces and net c) has six faces. So net b) has to go with the chicken salad lunch. Net c) goes with the BLT.

To draw the new nets, I figured out which edges were shared by faces but were not touching each other in the given nets. I redrew the given nets, except I moved one of the faces to a new position, making sure that it was connected to a face that shared an edge with it.

### Assessment of Learning: Lunch Containers

Level	Competency	Overall judgment at end of cycle
5	Advanced	The student's competency <b>exceeds</b> the requirements.
4	Thorough	The student's competency <b>clearly meets</b> the requirements.
3	Acceptable	The student's competency <b>barely meets</b> the requirements.
2	Partial	The student's competency <b>fails to meet</b> the requirements.
1	Minimal	The student's competency <b>clearly fails to meet</b> the requirements.

Competency 2: Uses mathematical reasoning	
Evaluation criteria for the competency: Uses mathematical reasoning	Observable elements The student . . .
CR 3- Proper application of mathematical reasoning suited to the situation	<ul style="list-style-type: none"> <li>• is able to select the appropriate net and its resulting 3-dimensional shape</li> <li>• provides justification for his/her choices</li> </ul>
CR 2- Correct use of concepts and processes appropriate to the situation	<ul style="list-style-type: none"> <li>• identifies proper nets of a shape</li> <li>• determines total area of pyramids and prisms</li> <li>• draws a different net that produces the same 3-dimensional shape as each of the given nets</li> </ul>
CR 4- Proper organization of the steps in an appropriate procedure	<ul style="list-style-type: none"> <li>• uses the given criteria to select the correct net for each container</li> <li>• shows his/her work in a clear and organized manner</li> </ul>
CR 5- Correct justification of the steps in an appropriate procedure	<ul style="list-style-type: none"> <li>• gives an explanation that justifies his/her conclusion</li> <li>• uses solid mathematical arguments in explanation of why the nets are matched to the correct containers</li> </ul>
CR 1- Formulation of a conjecture	

<b>Competency 2: Uses mathematical reasoning</b>					
<b>Evaluation Criteria</b>	<b>Advanced</b>	<b>Thorough</b>	<b>Acceptable</b>	<b>Partial</b>	<b>Minimal</b>
<b>Formulation of a conjecture appropriate to the situation</b>					
<b>Correct use of the concepts and processes appropriate to the situation</b>	<ul style="list-style-type: none"> <li>applied chosen geometric concepts appropriately</li> </ul>	<ul style="list-style-type: none"> <li>applied chosen geometric concepts appropriately, but made minor errors</li> </ul>	<ul style="list-style-type: none"> <li>applied chosen geometric concepts, but made some conceptual errors</li> </ul>	<ul style="list-style-type: none"> <li>applied chosen geometric concepts, but made several conceptual errors</li> </ul>	<ul style="list-style-type: none"> <li>applied geometric concepts inappropriately, making many conceptual errors</li> </ul>
<b>Proper application of mathematical reasoning suited to the situation</b>	<ul style="list-style-type: none"> <li>took every aspect of the given criteria (surface area and number of faces for each possibility) into account when determining which lunch matched each container</li> </ul>	<ul style="list-style-type: none"> <li>took the main aspects of the given criteria into account when determining which lunch matched each container</li> </ul>	<ul style="list-style-type: none"> <li>took some aspects of the given criteria (only surface area or number of faces) into account when determining which lunch matched each container</li> </ul>	<ul style="list-style-type: none"> <li>took few aspects of the given criteria into account when determining which lunch matched each container</li> </ul>	<ul style="list-style-type: none"> <li>took no aspect of the given criteria into account when determining which lunch matched each container</li> </ul>
<b>Proper organization of the steps in an appropriate procedure</b>	<ul style="list-style-type: none"> <li>presented a complete and organized procedure for selecting the net and 3-dimensional shape that clearly outlines what was done or how it was done</li> </ul>	<ul style="list-style-type: none"> <li>presented a complete and organized procedure for selecting the net and 3-dimensional shape that clearly outlines what was done or how it was done, even though some of the steps are not explained</li> </ul>	<ul style="list-style-type: none"> <li>presented a procedure for selecting the net and 3-dimensional shape that is not very clear about what was done or how it was done, because the work is unclear or not very organized</li> </ul>	<ul style="list-style-type: none"> <li>presented a procedure for selecting the net and 3-dimensional shape that consists of only isolated elements, showing little or no work that clearly outlines what was done or how it was done</li> </ul>	<ul style="list-style-type: none"> <li>presented a procedure for selecting the net and 3-dimensional shape that is completely unrelated to the situation OR does not show any procedure</li> </ul>
<b>Correct justification of the steps in an appropriate procedure</b>	<ul style="list-style-type: none"> <li>rigorously observed the rules and conventions of mathematical language in his/her explanation of how to determine which container went with each lunch</li> </ul>	<ul style="list-style-type: none"> <li>observed the rules and conventions of mathematical language, despite some minor errors or omissions in his/her explanation of how to determine which container went with each lunch</li> </ul>	<ul style="list-style-type: none"> <li>made some errors or is sometimes inaccurate in using the rules and conventions of mathematical language in his/her explanation of how to determine which container went with each lunch</li> </ul>	<ul style="list-style-type: none"> <li>made several errors related to the rules and conventions of mathematical language in his/her explanation of how to determine which container went with each lunch</li> </ul>	<ul style="list-style-type: none"> <li>showed little or no concern for the rules and conventions of mathematical language in his/her explanation of how to determine which container went with each lunch</li> </ul>

<b>Competency 3: Communicates using mathematical language</b>	
<b>Evaluation criteria for the competency: Communicates by using mathematical language</b>	<b>Observable elements The student . . .</b>
CR 1- Correct interpretation of a message involving at least one type of mathematical representation suited to the situation	<ul style="list-style-type: none"> <li>identifies a net that fits the given criteria using accurate mathematical language</li> <li>identifies the shape that would result from each net, using accurate mathematical terms</li> </ul>
CR 2- Production of a message suited to the context, using appropriate mathematical terminology and following mathematical rules and conventions	<ul style="list-style-type: none"> <li>provides a relevant explanation for his/her choices, using accurate mathematical language</li> </ul>

<b>Competency 3: Communicates by using mathematical language</b>					
<b>Evaluation Criteria</b>	<b>Advanced</b>	<b>Thorough</b>	<b>Acceptable</b>	<b>Partial</b>	<b>Minimal</b>
<b>Correct interpretation of a message involving at least one type of mathematical representation suited to the situation</b>	<ul style="list-style-type: none"> <li>used the elements of mathematical language and everyday language to efficiently give his/her explanation</li> </ul>	<ul style="list-style-type: none"> <li>used the elements of mathematical language and of everyday language appropriately in his/her explanation</li> </ul>	<ul style="list-style-type: none"> <li>used some elements of mathematical language and of everyday language in his/her explanation</li> </ul>	<ul style="list-style-type: none"> <li>used a few appropriate elements of mathematical language and of everyday language in his/her explanation</li> </ul>	<ul style="list-style-type: none"> <li>used inappropriate elements of mathematical language and of everyday language in his/her explanation</li> </ul>
<b>Production of an explanation for the design of the food display suited to the context, using appropriate mathematical terminology and following mathematical rules and conventions</b>	<ul style="list-style-type: none"> <li>produced an articulate, coherent explanation for the process of selecting of the nets and resulting shapes that includes all relevant information</li> </ul>	<ul style="list-style-type: none"> <li>produced a clear, well-organized explanation for the process of selecting of the nets and resulting shapes that includes the relevant information</li> </ul>	<ul style="list-style-type: none"> <li>produced an explanation for the process of selecting of the nets and resulting shapes that includes elementary, ambiguous, or repetitive information</li> </ul>	<ul style="list-style-type: none"> <li>produced an explanation for the process of selecting of the nets and resulting shapes that includes confusing and unconnected information</li> </ul>	<ul style="list-style-type: none"> <li>produced an explanation for the process of selecting of the nets and resulting shapes that includes erroneous or unrelated information</li> </ul>

## Situational Problem: Geometric Nutrition

<b>Preparation and Planning</b>	
Pacing	10–15 min    Introduction 45–60 min    Individual work
Materials	<ul style="list-style-type: none"> <li>• a calculator</li> <li>• a ruler</li> </ul>
Masters	<ul style="list-style-type: none"> <li>• Geometric Nutrition</li> <li>• Appendix B: <i>Menu and Nutritional Information</i></li> </ul>
Can be done after completing	<i>Nelson Mathematics Secondary Year One, Cycle One</i> Chapters 9, 10, 11, and 12

### Introduction (Whole Class) 10–15 min

Discuss the importance of eating healthy, well-balanced meals, and how good nutrition improves your overall health and well-being. Review with students the method for calculating the surface area of a 3-dimensional shape. Work an example together on the board. Remind students that drawing a net can sometimes be helpful when working with a 3-dimensional shape.

### Using the Situational Problem (Individual) 45–60 min

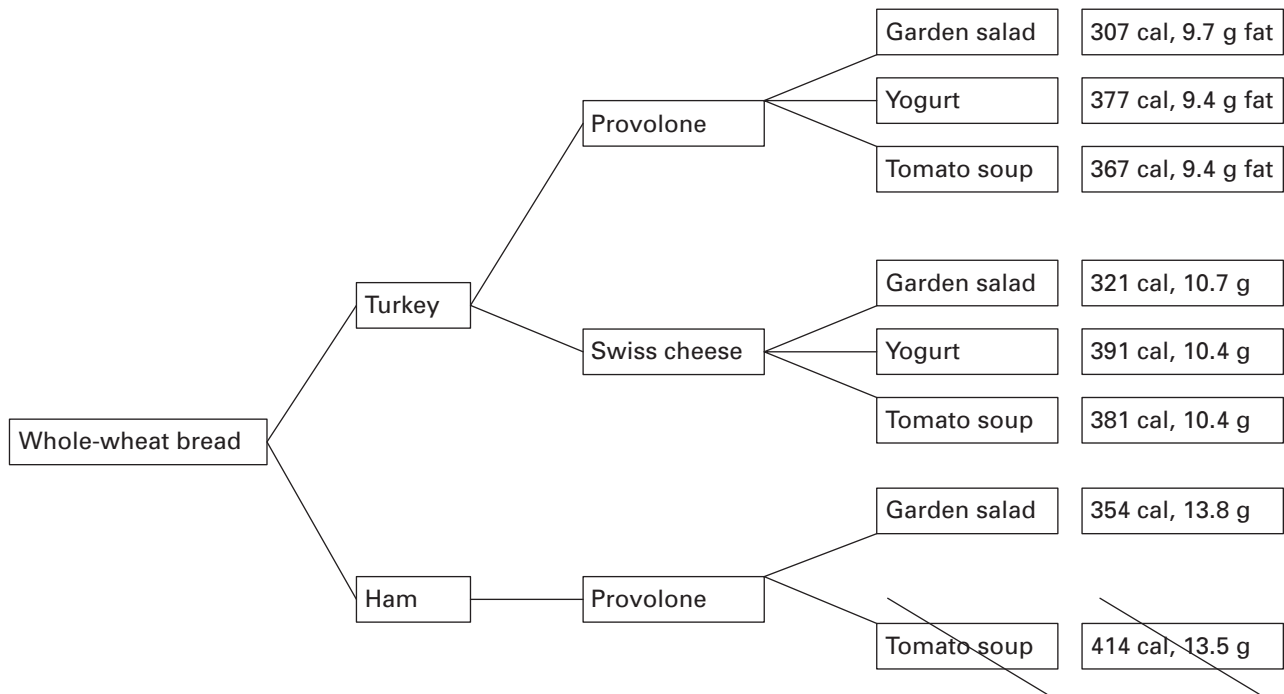
As a class, read *Geometric Nutrition* and review the criteria for creating the healthy, well-balanced lunch options and determining the amount of packaging needed. Remind students that nets may help them when calculating the surface area and to use the Evaluation Checklist to help them complete the activity.

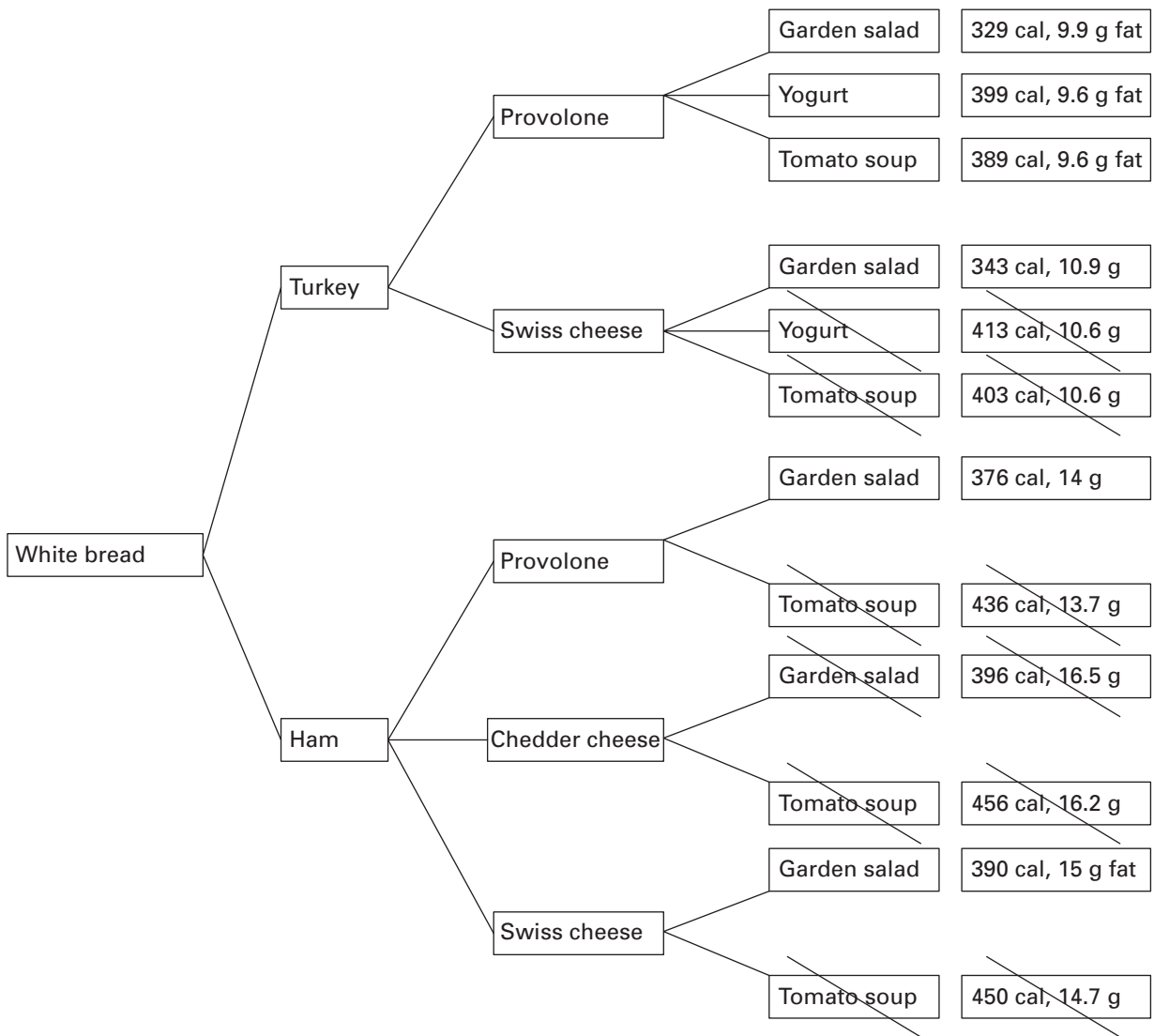
If students are having difficulty . . .	What you can do to help
Students may have difficulty creating a tree diagram to present possible choices.	<ul style="list-style-type: none"> <li>• Review with students the way a tree diagram is constructed. Urge them to follow each branch of the diagram to count all of the possible choices for each guest.</li> </ul>

## Sample Solution (Thorough)

A. To determine a variety of nutritious lunches that will meet all of the given criteria, I will create a tree diagram showing all of the possible choices. I will select one of the possible choices from this diagram for each of the twenty guests, matching the criteria given. Then, I will determine the number of cube containers and the number of rectangular prism containers that will be used. Finally, I will calculate the surface area of these shapes and multiply that answer by the number of containers of each shape that are needed.

B.





(Possible Solution) After creating the tree diagram, I have determined that I will prepare the following 20 lunches:

Guest	Bread	Meat	Cheese	Side
1	whole-wheat	turkey	Provolone	garden salad
2	whole-wheat	turkey	Provolone	yogurt
3	whole-wheat	turkey	Provolone	tomato soup
4	whole-wheat	turkey	Swiss	garden salad
5	whole-wheat	turkey	Swiss	yogurt
6	whole-wheat	turkey	Swiss	tomato soup
7	white	turkey	Provolone	yogurt
8	white	turkey	Swiss	garden salad
9	whole-wheat	ham	Provolone	garden salad
10	whole-wheat	ham	Provolone	garden salad
11	whole-wheat	ham	Provolone	garden salad
12	whole-wheat	ham	Provolone	garden salad
13	whole-wheat	ham	Swiss	yogurt
14	whole-wheat	ham	Swiss	tomato soup
15	whole-wheat	ham	Swiss	yogurt
16	whole-wheat	ham	Swiss	tomato soup
17	white	ham	Provolone	garden salad
18	white	ham	Provolone	garden salad
19	white	ham	Swiss	garden salad
20	white	ham	Swiss	garden salad

I will need 4 white cube containers and 2 blue cube containers. I will also need 8 white rectangular prism containers and 6 blue rectangular prism containers. The total surface area of the given cube is  $864 \text{ cm}^2$ . The surface area of the rectangular prism is  $1728 \text{ cm}^2$ . I have determined that I will need  $17\,280 \text{ cm}^2$  (or about  $1.73 \text{ m}^2$ ) of white cardboard for the packaging and  $12\,096 \text{ cm}^2$  (or about  $1.21 \text{ m}^2$ ) of the blue.

- C. I followed the plan outlined in step A, with one change. I needed to calculate how many total calories and grams of fat were present in each lunch to make certain that none of the meals had more than were allowed. Some of the meals did go beyond the maximum allowable number of calories or fat grams; therefore, these meals had to be crossed off of my list of possible selections.
- D. I created a tree diagram that showed all possible selections from the menu, using the given criteria. I then used the nutritional guidelines to eliminate some of the possible choices. Then, I used the percents and fractions given for guest preferences to determine how many of each type of meal I should prepare. As I added the calories and total fat content of all contents in each lunch, I am certain that every lunch I prepare meets the provided nutritional guidelines. Each lunch also contains foods from a variety of food groups and low calorie, low fat options were provided.

## Assessment of Learning: Geometric Nutrition

<b>Competency 1: Solves a situational problem</b>					
<b>Evaluation Criteria</b>	<b>Advanced</b>	<b>Thorough</b>	<b>Acceptable</b>	<b>Partial</b>	<b>Minimal</b>
<b>Oral or written explanation showing that the student understands the situational problem</b>	<ul style="list-style-type: none"> <li>took all of the given criteria into account when selecting the lunch options</li> </ul>	<ul style="list-style-type: none"> <li>took most of the given criteria into account when selecting the lunch options</li> </ul>	<ul style="list-style-type: none"> <li>took some of the given criteria into account when selecting the lunch options</li> </ul>	<ul style="list-style-type: none"> <li>took few of the given criteria into account when selecting lunch options</li> </ul>	<ul style="list-style-type: none"> <li>took no more than one of the given criteria into account when selecting lunch options</li> </ul>
<b>Mobilization of mathematical knowledge appropriate to the situational problem</b>	<ul style="list-style-type: none"> <li>presented a correct solution for calculating surface area</li> </ul>	<ul style="list-style-type: none"> <li>presented a solution with few errors related to the geometric concepts for calculating surface area</li> </ul>	<ul style="list-style-type: none"> <li>presented a solution with errors related to the geometric concepts for calculating surface area</li> </ul>	<ul style="list-style-type: none"> <li>presented a partial solution of only the easiest steps with several errors in calculating surface area</li> </ul>	<ul style="list-style-type: none"> <li>presented a partial solution with several major errors in calculating surface area OR no solution</li> </ul>
<b>Development of a solution (i.e. a procedure and a final answer) appropriate to the situational problem</b>	<ul style="list-style-type: none"> <li>checked his/her lunch selections and surface area calculations and corrected them, if necessary</li> </ul>	<ul style="list-style-type: none"> <li>checked the main steps in making his/her lunch selections and surface area calculations and corrected them, if necessary</li> </ul>	<ul style="list-style-type: none"> <li>checked some of the steps in making his/her lunch selections and surface area calculations</li> </ul>	<ul style="list-style-type: none"> <li>made little attempt to question his/her lunch selections or surface area calculations</li> </ul>	<ul style="list-style-type: none"> <li>did not question his/her lunch selections or surface area calculations</li> </ul>

<b>Cross-Curricular Competencies</b>					
<b>Evaluation Criteria</b>	<b>Advanced</b>	<b>Thorough</b>	<b>Acceptable</b>	<b>Partial</b>	<b>Minimal</b>
<b>Cross-Curricular Competencies 2: Solve problems</b>					
<b>Accurate definition of the problem</b>	<ul style="list-style-type: none"> <li>student showed a clear understanding of the criteria presented for making lunches and clearly demonstrated this in the explanation</li> </ul>	<ul style="list-style-type: none"> <li>student showed a clear understanding of the criteria presented for making lunches</li> </ul>	<ul style="list-style-type: none"> <li>student showed a somewhat clear understanding of the criteria presented for making lunches</li> </ul>	<ul style="list-style-type: none"> <li>student showed a lack of complete understanding of the criteria presented for making lunches</li> </ul>	<ul style="list-style-type: none"> <li>student did not show any understanding of the criteria presented for making lunches</li> </ul>
<b>Evaluation of possible strategies</b>	<ul style="list-style-type: none"> <li>an accurate evaluation of the plan was provided and alternative strategies and steps were discussed for the possible methods of selecting lunches and calculating surface area of packaging</li> </ul>	<ul style="list-style-type: none"> <li>an accurate evaluation of the plan was provided for the possible methods of selecting lunches and calculating surface area of packaging</li> </ul>	<ul style="list-style-type: none"> <li>an evaluation of the plan was provided but it lacked several details for the possible methods of selecting lunches and calculating surface area of packaging</li> </ul>	<ul style="list-style-type: none"> <li>an unclear evaluation of a plan was provided for the possible methods of selecting lunches and calculating surface area of packaging</li> </ul>	<ul style="list-style-type: none"> <li>no evaluation of a plan was provided for the possible methods of selecting lunches and calculating surface area of packaging</li> </ul>
<b>Scope of the analysis</b>	<ul style="list-style-type: none"> <li>an accurate analysis of the plan for selecting lunches and calculating surface area of packaging was performed and the explanation details specific uses of this information</li> </ul>	<ul style="list-style-type: none"> <li>an accurate analysis of the plan for selecting lunches and calculating surface area of packaging was performed</li> </ul>	<ul style="list-style-type: none"> <li>an analysis of the plan for selecting lunches and calculating surface area of packaging was performed but contained some errors</li> </ul>	<ul style="list-style-type: none"> <li>an inaccurate analysis of the plan for selecting lunches and calculating surface area of packaging was performed</li> </ul>	<ul style="list-style-type: none"> <li>no analysis of the plan for selecting lunches or calculating surface area of packaging was performed</li> </ul>

<b>Evaluation Criteria</b>	<b>Advanced</b>	<b>Thorough</b>	<b>Acceptable</b>	<b>Partial</b>	<b>Minimal</b>
<b>Cross-Curricular Competency 3: Exercises critical judgment</b>					
<b>Appropriateness of the criteria used</b>	<ul style="list-style-type: none"> <li>used all given criteria in selecting applicable lunch options</li> </ul>	<ul style="list-style-type: none"> <li>used the most important criteria in selecting lunch options</li> </ul>	<ul style="list-style-type: none"> <li>made some attempt to distinguish relevant criteria from irrelevant criteria when selecting lunch options</li> </ul>	<ul style="list-style-type: none"> <li>made little attempt to distinguish relevant criteria from irrelevant criteria when selecting lunch options</li> </ul>	<ul style="list-style-type: none"> <li>was not able to distinguish relevant criteria from irrelevant criteria when selecting lunch options</li> </ul>
<b>Well-reasoned justification of the judgment</b>	<ul style="list-style-type: none"> <li>rigorously observed the rules and conventions of mathematical language in his/her justification of the solution</li> </ul>	<ul style="list-style-type: none"> <li>observed the rules and conventions of mathematical language in his/her justification of the solution</li> </ul>	<ul style="list-style-type: none"> <li>made some errors or is sometimes inaccurate in using the rules and conventions of mathematical language in his/her justification of the solution</li> </ul>	<ul style="list-style-type: none"> <li>made several errors related to the rules and conventions of mathematical language in his/her justification of the solution</li> </ul>	<ul style="list-style-type: none"> <li>showed little or no connection with the rules and conventions of mathematical language in his/her justification of the solution</li> </ul>
<b>Cross-Curricular Competency 8: Cooperates with others</b>					
<b>Active participation in the work of the team</b>	<ul style="list-style-type: none"> <li>if worked in pairs, made suggestions and listened to input from partner; shared equally in the work</li> </ul>	<ul style="list-style-type: none"> <li>if worked in pairs, made suggestions and listened to input from partner, but amount of work done was not quite equal</li> </ul>	<ul style="list-style-type: none"> <li>if worked in pairs, partners worked separately, only comparing answers when each had finished working</li> </ul>	<ul style="list-style-type: none"> <li>if worked in pairs, one partner did almost all of the talking, while the other partner offered little to the discussion</li> </ul>	<ul style="list-style-type: none"> <li>if worked in pairs, partners worked separately, not even comparing answers when each had finished</li> </ul>