Answer Key

CHAPTER 1
UNIT PRICING AND CURRENCY EXCHANGE
1.1 PROPORTIONAL REASONING

PRACTISE YOUR NEW SKILLS, PAGE 21

1. 8 to 2; 8:2; $\frac{8}{2}$
2. 36 minutes, rounded to the nearest minute.
3. 5 trucks: 75 minutes; 2 tires: 7.5 minutes
4. 13 cars were sold on each day; the proportion of cars sold on Saturday is 13:36.
5. 121 cm tall, to the nearest centimetre.
6. 50 DVDs: $637.50; 900 DVDs: $11 475.00
7. The restaurant could buy 25 kg of olives for $75.00; it would cost $60.00 to buy 20 kg of olives.
8. red mahogany: 6.86 L; Spanish oak: 5.14 L

Extend your thinking

9. Yuki is closer to being right (5.57 days). However, both Keiko and Yuki underestimated how fast the Shinkasen can go.

1.2 UNIT PRICE

BUILD YOUR SKILLS, PAGE 26

1. $87.75
2. The third package (21 kg for $50.99) has the lowest unit cost of $2.43/kg.
3. The first supplier has the lower cost per lock; Answers may vary. Example: You should consider the quality of the locks, since you want them to be secure.
4. a) package of two: $7.75/shirt; package of three: $7.66/shirt

   b) The best combination is to buy one package of 3 shirts and two packages of 2 shirts for $53.97.
5. The second price is the best at $12.50/kg; the customer should buy 1 kg at the second price and 1.5 kg at the third.
6. The last package of meat, $29.50 for 2 kg, has the lowest unit price; the store from question 5 has two unit prices that are lower than this, so it would be better to buy your meat at the other store.

Extend your thinking

7. The least expensive combination is 3 large kits and 1 medium kit at a price of $269.75.

1.3 SETTING A PRICE

BUILD YOUR SKILLS, PAGE 32

1. $36.40/shirt
2. $325.34; the GST is $15.49.
3. $217.68
4. $1099.76
5. a) $1373.25

   b) Parminder receives $150.00 more if she sells directly from her farm; answers may vary. Example: Parminder might receive larger orders by selling to wholesalers.
6. a) $2.88

   b) $38.00

   c) Answers may vary. Example: Julie could source less expensive ingredients and supplies.
7. Answers may vary. Example: 50% discount is common for out-of-season items. Marie's profits will be lower, but some revenue is better than no revenue. Marie might reason that it would be best to recover some of her costs.

Extend your thinking

8. At cost, 250 g is $4.38.

   a) Answers may vary. Example: Pricing factors include overhead costs such as the rent and utilities.

   b) $6.13

   c) $5.21

   d) Yes, you would still be making a gross profit because your product has still been marked up by 25%.

1.4 ON SALE!

BUILD YOUR SKILLS, PAGE 37

1. a) $8.84

   b) Marylyn saves 25% because she has saved $2.94, which is about 25% of $11.78.
2. a) Ross's store: $52.45; Al's store: $49.94

   b) Yes, Al is right. With the sale, the racquet at his store is less expensive.
3. a) Morning appointments will get you the lowest price.

   b) Answers may vary. Example: The coupon will appeal more because you know how much you are saving without having to do any calculations.
4. $1831.50; $28.80
5. a) store 1: $3132.15; store 2: $3129.00

   b) The second wholesaler offers a better buy.
6. a) shirts: 38%; shorts: 32%; jacket: 50%

   b) $45.00 total savings. The customer would save the most money on the jacket ($25.00).

Extend your thinking

7. a) regular price: $1601.60; discount price: $1521.52; savings: $80.08

   b) $7.28

1.5 CURRENCY EXCHANGE RATES

BUILD YOUR SKILLS, PAGE 47

1. a) 1.644 814
   b) 0.133 451
   c) 0.019 360
2. a) 0.009 295
   b) 0.950 964
   c) 1.004 350
3. a) $375.49 CAD
   b) $3211.28 CAD
   c) $3477.79 CAD
   d) $17 057.07 CAD
4. €729.57
5. a) 395.18 euros
   b) 639.13 francs
   c) 3702.48 kronor
   d) $612.98 CAD; Opal receives a lower amount back because bank buy and sell rates are different—the banks build in a profit margin for exchanging money.
6. Pebble Beach: $5193.25 CAD
   St. Andrew's: $17 511.24 CAD
   Spring City Golf & Lake Resort: $4325.16 CAD
   SAFRA Resort & Country Club: $11 434.20 CAD
   Leopoldsdorf: $6579.26 CAD

Extend your thinking

7. a) Answers will vary because conversions change daily. Example: US$8.73 (rate: 1 CAD = 0.975229 USD); AU$9.39 (rate: 1 CAD = 1.04905 AUD)
   b) US price: US$9.91; Australian price: AUD$11.51

PRACTISE YOUR NEW SKILLS, PAGE 50

1. a) 40 km; 200 km
   b) $15.90 CAD
2. 300 loaves
3. a) 7.5 m/second
   b) $0.23/egg
4. No, you can't use a photocopier to enlarge a 4 × 6 photo to another standard photo size because the sizes are not proportional to each other; you can make any proportion that is equivalent to 8:10. For example, 4:5 or 2.5:3.125.
5. a) unit price of 5 lb bag: $0.38/lb; unit price of 20 lb bag: $0.30/lb; the 20-lb bag is the better buy.
   b) Answers may vary. Example: You will want to consider the quality of the potatoes and the quantity that you can use.
   c) This is the best buy at a unit price of $0.20/lb. However, you may have reasons other than price to consider. Example: You may not be able to use 75 lbs of potatoes.

6. Too Good To Be True offers the best deal ($955.49 instead of $999.99).

7. a) 5 cups of flour

   b) flour: $1\frac{2}{3}$ cups; sugar: $\frac{1}{3}$ cup

8. a) $795.00 CAD

   b) $798.98 CAD

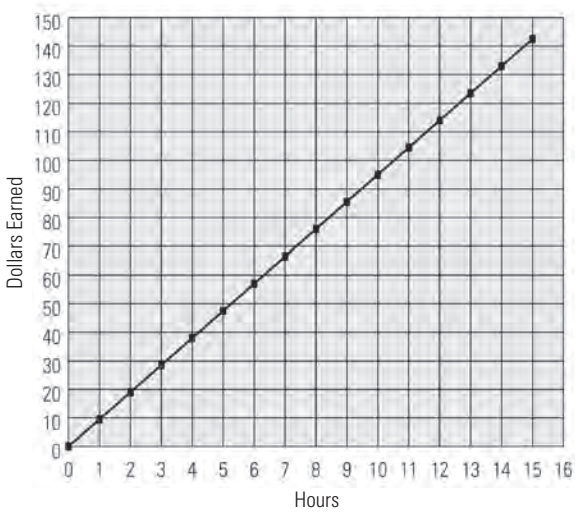
9. $1284.05 CAD

10. a) $9.50/h

    b)

CALCULATING EARNINGS	
Hours	*Dollars earned*
0	0
1	$9.50
2	$19.00
3	$28.50
4	$38.00
5	$47.50

    c)



    d) 3.5 hours of work: $33.25; 12.5 hours of work: $118.75

CHAPTER 2
EARNING AN INCOME
2.1 WAGES AND SALARIES

BUILD YOUR SKILLS, PAGE 60

1. a) $947.20/week

   b) $49 254.40/year

2. Biweekly payments occur every second week; semi-monthly payments occur twice a month.

3. Calculate how many hours Luc works in a month (4.33 weeks). Then, divide Luc's monthly pay by his monthly hours (52 h/month). Luc earns about $9.56/h.

4. Factors to consider: how many lawns you can cut in an hour; whether you are a particularly fast worker; whether the job would take longer under some conditions (such as wet grass).

5. Her monthly wage is $496.74. Her earnings would increase by $152.76 a month.

6. $30.00/h

7. a) $30 539.19

   b) $32 398.91

8. **Nov. 15**

   a) 3 h 2 min

   b) 3.03 h, rounded

   Nov. 16

   a) 5 h 4 min

   b) 5.07 h, rounded

Nov. 17

a) 3 h 2 min

b) 3.03 h, rounded

Nov. 18

a) 5 h 31 min

b) 5.52 h

Nov. 19

a) 3 h 28 min

b) 3.47 h

c) $192.00

d) It is preferable to start and end at the specified times because you don't get paid more for starting a few minutes early or leaving a few minutes late.

9. a) Errors on Franco's pay statement: End date is earlier than the begin date; end date year is 2100 instead of 2010; total hours should be 32.5; gross earnings should be $290.88.

b) Errors on Christine's pay statement: Two different pay rates are listed; her gross earnings should be $224.19.

c) Inform your supervisor or payroll clerk of the error.

Extend your thinking

10. a) Some factors to consider include pay, length of time the jobs last, cost and time involved in commuting, additional perks or benefits each job provides, and how interested you are in each kind of work.

b) How many hours a week you would be working at the community centre job and the cost of transportation for the painting job.

c) The house-painting job may require some overtime if a particular job has a deadline that must be met because of weather.

d) Overtime might be appealing to earn extra money; you might not want to work overtime if you have other commitments.

2.2 ALTERNATIVE WAYS TO EARN MONEY

BUILD YOUR SKILLS, PAGE 69

1. Benefits of self-employment include being your own boss and being able to set your own hours. Disadvantages include that you don't get paid holidays or benefits and you have to promote your business yourself. Answers to the last question will vary.

2. a) The profit is $75.00.

b) The profit is 15%.

c) He could not adjust the price because he signed a contract to deliver the product for a fixed price.

3. a) $14.87/h

b) To raise his hourly rate, Leo would have to work more quickly so he could complete the contracts in fewer hours, or lower his material costs.

4. If she is a fast worker, piecework might be the better option because she could earn $0.50 an hour more.

5. a) $2200.00

b) An average of 4 h at $50.00/h. She would not want to spend more than 5 or 6 h.

c) $15 200.00

6. $66 666.67

7. a) $360.00

   b) Piecework is beneficial if the worker is efficient and can earn more than he or she would on an hourly basis. Working piecework allows the worker to decide how much work to take on.

   c) For an employer, paying by piecework means not paying benefits such as holiday pay or sick time. A disadvantage would be that a worker may not always be available.

Extend your thinking

8. a) Measure the length, width, and height of each wall and the dimensions of the fireplace and patio door, along with other open space such as a hallway.

   b) Other calculations include the price of primer, paint, edging tools, plastic, brushes and rollers, and so on. You would need to estimate the time involved, having determined how many coats of paint are needed.

   c) Let x = cost of supplies

   Let y = cost of labour

   Total cost = $x + y$

   Profit equals total costs subtracted from contract amount.

   Let P = profit

   Let C = costs

   Let A = amount of contract

   $P = A - C$

   Percentage profit equals amount of profit divided by amount of contract.

   Let Z = percentage profit

   $Z = P \div A$

2.3 ADDITIONAL EARNINGS

BUILD YOUR SKILLS, PAGE 76

1. a) $74 050.00

   b) $6170.83

2. $7.60

3. Tristan will earn about $2240.00 in 4 weeks.

4. a) Let x = number of hours worked

   Let y = number of workers per shift

   Let z = amount of tips

   x ($8.00/h) + $\frac{z}{y}$

   b) No, Layla is incorrect. She earned $65.87, not $68.21.

5. $48 300.00

6. $225.73

7. a) 6 h

   b) $150.88

   c) 75%

   d) 25%

Extend your thinking

8. a) $196.81

   b) This mileage allowance is probably fair, although if there is too much wear and tear on a personal vehicle, it might be too low. Consider the costs of fuel, insurance, and repair and maintenance.

2.4 DEDUCTIONS AND NET PAY

BUILD YOUR SKILLS, PAGE 87

1. Gross income is the total income earned in a pay period. Taxable income is gross income minus before-tax deductions such as union dues, pension contributions, dental coverage, and so on.

2. a) Friend 2 has a higher salary.

   b) The person who gets paid twice a month would have higher deductions per pay period.

3. Look up the EI premium rate for the year and multiply the gross pay by this rate.

4. a) $3026.54 semi-monthly

   b) Taxable income is higher than net pay because income tax, CPP, and EI are deducted from the taxable income to calculate the net pay.

5. Amber's net pay is $811.12.

6. a) Prince Rupert job: $109.31.

   Skeena River job: $109.31

   b) $86.50

   c) Prince Rupert job: $305.50

   Skeena River job: $304.00

   d) $4086.88

7. a) Yes, Pierre was paid the correct amount. After his pay deductions, he received $1379.58.

   $1730.77 – $172.98 – $69.82 – $78.45 – $29.94 = $1379.58

   b) No, he was not paid the correct amount. After his pay deductions, he should have received $1317.08.

   $1730.77 – $172.98 – $69.82 – $78.45 – $29.94 – $62.50 = $1317.08

Extend your thinking

8. a) $5770.00

   b) $4012.50

PRACTISE YOUR NEW SKILLS, PAGE 89

1. $8.40

2. The waiters will earn slightly more on Thursday than on Friday.

   Steps:

   1. Divide the total amount of tips from each day by the number of waiters working that day.

   2. Calculate the wages earned on each night.

   3. Add each waiter's tips to the wages and compare the amounts for the two nights.

3. a) $252.00

   b) $84.00

4. a) $2075.00

   b) 23%

   c) A business with 23% of total income as earnings is healthy, but there are probably other expenses, such as the cost of renting space or marketing activities.

5. $500.00

6. Info required: earnings; pay period; claim code; EI premium rate; CPP basic exemption and contribution rate; benefits and other deductions.

   Equipment needed: calculator, computer with internet access, tax tables or online payroll calculator.

7. a) Federal: $130.15

   b) Provincial: $63.50

   c) You would need the provincial tax tables for BC.

8. a) $1423.08

   b) CPP: $63.78; EI: $24.62; federal tax: $132.40; AB tax: $66.50

   c) $1135.78.

9. Answers will vary. A straight commission job may provide more freedom, for example, the opportunity to work from home or to only work when you want to. Also, your compensation is directly tied to your performance. However, you wouldn't have the regular paycheque and employment benefits that come with a salaried job. The advantages of a salary-plus-commission job include the security of a regular paycheque and benefits; however, having to work full time and report to a supervisor could be seen as a disadvantage.

CHAPTER 3
LENGTH, AREA, AND VOLUME
3.1 SYSTEMS OF MEASUREMENT

BUILD YOUR SKILLS, PAGE 102

1. a) 2 miles

   b) $120\frac{3}{16}$ inches

   c) $26\frac{1}{4}$ ft

2. 360 bouquets

3. No, her suitcase is 3″ too big.

4. a) You will need 25 sheets of plywood.

   b) The plywood will cost $353.75.

5. It will cost $39.96 to put edging around the garden.

6. The fitter will need 14 rails.

7. a) Noah must buy 8 yards of fabric.

   b) The drapes will cost $120.00.

8. If baseboards are installed around the vanity, the job will cost $254.53. If baseboards are not installed around the vanity, the job will cost $213.41. Assume that the carpenter will not put baseboards in front of the tub or in the door opening.

Extend your thinking

9. The insulator will need seven packages.

3.2. CONVERTING MEASUREMENTS

BUILD YOUR SKILLS, PAGE 111

1. The bridge is 2.286 m high. The truck will not fit under the bridge.
2. The altitude is 13 779.5 feet.
3. Valerie is 172.72 cm tall.
4. The total cost is $728.00.
5. Company A will charge $3827.08 and Company B will charge $4000.00, so Company A should get the job.
6. Hardwood will cost $2126.67 and carpet will cost $2206.05, so hardwood costs less.
7. a) Irina can plant 658 seedlings.

   b) The seedlings will cost $429.00.
8. The total estimate is $872.50.

Extend your thinking

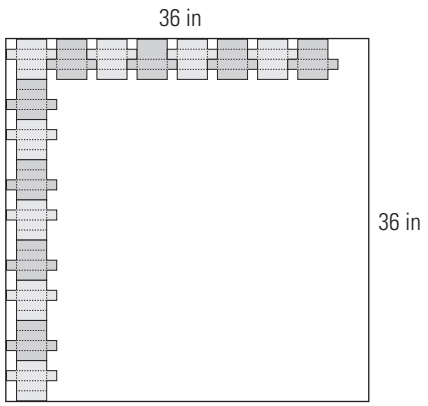
9. The total cost will be $983.30.

3.3 SURFACE AREA

BUILD YOUR SKILLS, PAGE 121

1. a) He can make 4 pond liners from one roll.

   b) It costs $37.25 to line one pond.
2. Can A requires 45.16 in^2 of aluminum to manufacture and Can B requires 42.41 in^2 of aluminum to manufacture, so Can A requires more aluminum to manufacture.
3. Jashandeep needs enough paint to cover 48 ft^2, so she needs one quart of paint, which costs $14.99. She needs enough stain to cover 4.46 m^2, so she needs one litre of stain, which costs $12.99. The stain is the cheaper option.
4. To build the hopper will require 81.70 yd^2 of sheet metal.
5. a) Francine should buy 155 bricks.

   b) The bricks will cost $124.00.
6. 

Extend your thinking

7. It will cost $151.20 to carpet the scratching post.

3.4 VOLUME

BUILD YOUR SKILLS, PAGE 132

1. He will need 750 mL of milk.
2. 12 US fl oz = 355 mL

   16 US fl oz = 474 mL

   28 US fl oz = 829 mL

   40 US fl oz = 1184 mL

3. The box measures 30.48 cm × 15.24 cm × 20.32 cm, so the game will fit in the box.

4. It will cost him $55.00 to fill his tank.

5. J & L Concrete charges $931.48 and M & W Concrete charges $823.35, so Everett should buy from M & W concrete.

6 Elann should order 2.5 yd^3 of concrete.

Extend your thinking

7. The car uses 5.22 L per 100 km, so the car is more fuel efficient than the minivan.

PRACTISE YOUR NEW SKILLS, PAGE 134

1. It will cost $7800.00 to install the benches.

2. It will cost $270.25 to replace the mouldings.

3. The painter will charge $3342.95 to do this job.

4. The total cost of the metal primer will be $141.39.

5. The cone is made from 4.78 ft^2 of aluminum.

6. It is 141.06 miles to the next service station. She has enough gas to drive another 252 miles, so she doesn't need to stop for gas now.

7. If the farmer buys the 1 yd^3 bales, he will need 10 bales, which will cost $390.00. If he buys the 3.8 ft^3 bales, he will need 71 bales, which will cost $886.79. The 1 yd^3 bale would give the farmer the best total price.

8. Dawai needs 1.665 yd^3 of soil. At Dirt for Less, 1.665 yd^3 of soil would cost $26.62 and 2 yd^3 would cost $31.98. If he converts the volume to metres, he needs 1.27 m^3 of soil. At Rocks and Soils, 1.27 m^3 of soil would cost $24.11 and 2 m^3 would cost $37.98.

   a) If Dawai can buy fractions of a cubic yard or metre, he should buy from Rocks and Soils.

   b) If he must buy whole cubic yards or metres, he should buy from Dirt for Less.

9. a) The total volume of concrete needed to build the wall is 4.57 yd^3.

      i) Steve will need 0.65 yd^3 of cement.

      ii) Steve will need 1.31 yd^3 of sand.

      iii) Steve will need 2.61 yd^3 of gravel.

   b) The job will cost $1589.29.

CHAPTER 4
MASS, TEMPERATURE, AND VOLUME
4.1 TEMPERATURE CONVERSIONS

BUILD YOUR SKILLS, PAGE 143

1. ground meats: 71°C; beef (medium rare): 63°C; beef (well-done): 77°C; chicken (whole): 74°C

2. Mandy will have to modify the asphalt paving mixture if the temperature falls below 70°F. Temperature would affect it because asphalt becomes more fluid as it is heated.

3. Chan will not have to work if the temperature is above 41°C or below –26°C.

4. The surface temperature of the crimper is (446 ± 18)°F. The temperature of the crimper is between 428°F and 464°F.

5. a) Answers will vary.

   b) Answers will vary.

   c) Bev likes to keep her house between 64°F and 72°F.

Extend your thinking

6. –40°C = –40°F

4.2 MASS IN THE IMPERIAL SYSTEM

BUILD YOUR SKILLS, PAGE 151

1. a) i. a pat of butter

   b) ii. a small basket of raspberries

   c) iii. blue whale

2. a) pounds

   b) pounds

   c) ounces or for a larger box, pounds

   d) tons

   e) pounds or pounds and ounces

   f) pounds

   g) tons

3. a) Newborn babies are small and a few ounces is a relatively large portion of their size.

   b) 121 oz

   c) It is easier to visualize between 7 and 8 pounds than it is to visualize 115 ounces.

   d) 8 lb 1 oz

   e) Johan weighed approximately $\frac{8}{121} \approx 0.07$ more at 5 weeks than at birth.

   f) If he had weighed less at birth, the amount lost during the first week would have been less, and his weight gain would have been proportionately more, but if he weighed more at birth it would have the opposite effect.

4. $3504\frac{1}{6}$ lb or 3504.2 lb

5. a) Petroleum products are the most highly traded commodity.

   b) The farmer received $1181.25 and Hon received $12 116.25. Hon received $10 395.00 more for his coffee than the farmer received. This is almost 10 times more than the farmer received.

Extend your thinking

6. a) Although it doesn't sound like much, this would be a fair price for coffee beans given the cost of living for farmers in the countries that grow beans.

   b) Hon would have paid considerably more for the beans than $1.35/lb because of the distributors involved, the cost of transportation, and so on.

7. Sam forgot to consider the maximum weight that Pete's truck can carry. Pete will have to make 9 trips.

4.3 MASS IN THE SYSTÈME INTERNATIONAL

BUILD YOUR SKILLS, PAGE 158

1. a) ii. a penny

   b) i. this textbook

   c) i. a thumbtack

   d) i. a bull

2. a) No. Even a small truck would weigh more than a tonne.

   b) No. A newborn baby weighs 3000 or 4000 grams.

   c) No. A hockey puck weighs considerably less—about 150 to 170 g.

   d) Yes

   e) Yes

   f) Yes

   g) No. One tonne is 1000 kg, which is about 2200 lb.

   h) No. A pound is less than half a kilogram.

3. a) You will have to take 2 pills at a time.

   b) 7500 mg

   c) 0.0075 kg

4. nitrogen: 30 kg; phosphorus: 35 kg; potassium: 25 kg

5. The air in the tank weighs 44 956.5 g or approximately 45 kg.

6. You would buy 398 g, 124 g, and 97 g of cheese.

7. 625 kg

Extend your thinking

8. a) Jupiter

   b) Mercury

4.4 MAKING CONVERSIONS

BUILD YOUR SKILLS, PAGE 165

1. Each ball weighs approximately 142 g.

2. Raj will need to order 36 bags.

3. a) 146.73 kilograms per square metre

   b) i. 30 770 pounds

      ii. 13 986.36 kg

4. a) 102.24 kg

   b) 225 lb

5. a) 520 lb

   b) 236.4 kg

6. There are approximately 1062 bushels of wheat in the pile.

7. Jason should have an elevator with at least a 2000 pound capacity.

Extend your thinking

8. a) $180.98

   b) $4.77/kg

   c) ground beef: 21.8 kg; chuck roast: 3.4 kg; sirloin roast: 3.1 kg; grilling steak: 4.5 kg; T-bone: 3.3 kg; stewing meat: 1.8 kg

   d) When you check the prices of the meat in the grocery store, especially if the meat was on sale, you will probably find that Arduk did not save much, if any money.

   e) Answers will vary. Example: Fruits and vegetables can often be purchased directly from the producer.

   f) Answers will vary. Example: The food would often be fresher.

PRACTISE YOUR NEW SKILLS, PAGE 169

1. 113°F is equivalent to 45°C; –55°F is approximately equivalent to –48°C

2. The coldest recorded temperature would have been approximately –81°F.

3. a) A 5-US gallon pail of water weighs approximately 19 kilograms.

   b) 1000 kg

4. a) 13 565 g or 13.565 kg

   b) 200 g

   c) 5

5. 150 lb

6. 1334.28 kg; 2935.42 lb

7. 47.6 tonnes

8. You could create a type of balance using a sawhorse or some other device as the fulcrum and a solid piece of wood or a 2 × 4 as the arms. Place the rock on one end of the 2 × 4. Place the cement bags, one at a time, on the other end. When the cement balances the rock, count the number of bags and multiply by 20.

9. a) 378 787.88 kg

   b) 421.6 ft^3

   c) 660 lb

Extend your thinking

10. pork: $8\frac{2}{3}$ oz; beef: 4 oz; potatoes: $4\frac{2}{3}$ oz

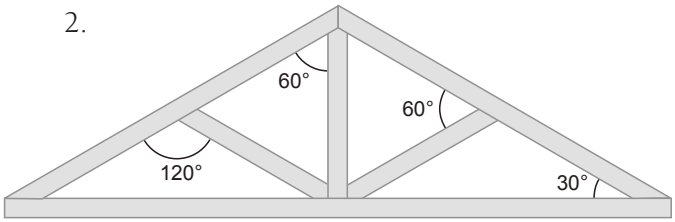
CHAPTER 5
ANGLES AND PARALLEL LINES
5.1 MEASURING AND ESTIMATING ANGLES

BUILD YOUR SKILLS, PAGE 184

1. a) 26.5° (A good estimation would be either 25° or 30°.)

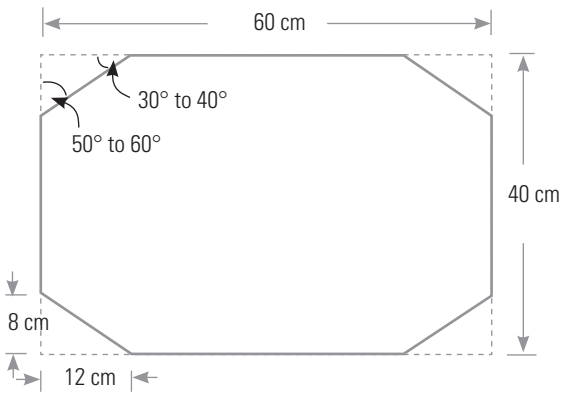
   b) 243° (A good estimation would be either 240° or 245°.)

2.

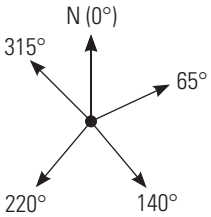


3. Only a 40° angle will add up to 90° with a 50° angle. So, the bottom ends of the side pieces of the frame must be cut so that the angles measure 40°.

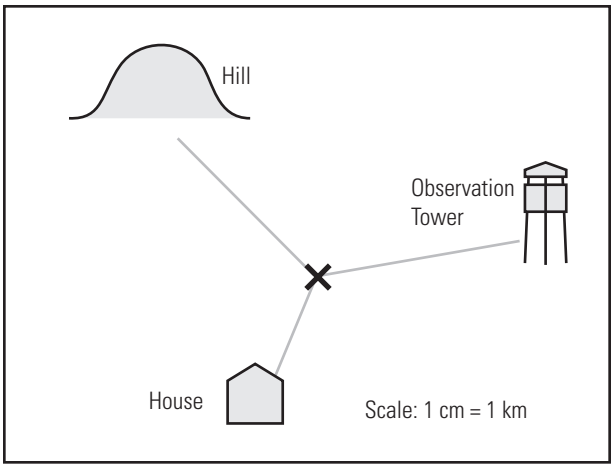
4. The measures of the angles of the cuts should be 30° to 40° (from the horizontal) and 50° to 60° (from the vertical.) The exact measurements are 33.7° from the horizontal and 56.3° from the vertical.



5.



6.



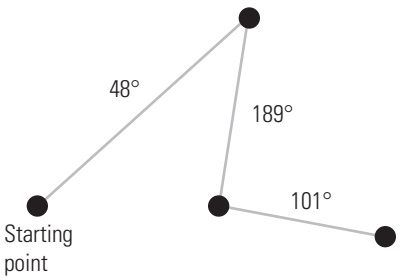
Extend your thinking

7. a) Subtract 6° from the azimuths to get the compass degrees.

   b) The compass reading for the first leg is 48°.

   The compass reading for the second leg is 189°.

   The compass reading for the third leg is 101°.



5.2 ANGLE BISECTORS AND PERPENDICULAR LINES

BUILD YOUR SKILLS, PAGE 192

1. a) The angle measures 27°. The bisected angle measures 13.5°.

   b) The angle measures 84°. The bisected angle measures 42°.

   c) The angle measures 90°. The bisected angle measures 45°.

   d) The angle measures 262°. The bisected angle measures 131°.

2. a) Angle made by strips 1 and 2: 50°
   Angle made by strips 2 and 3: 100°
   Angle made by strips 1 and 3: 30°

   b) Bisector for strips 1 and 2:

   $$50° \div 2 = 25°$$

   Bisector for strips 2 and 3:

   $$100° \div 2 = 50°$$

   Bisector for strips 1 and 3:

   $$30° \div 2 = 15°$$

   c) The ends of strips 1 and 2 must be cut at 25° angles where they meet.
   The ends of strips 2 and 3 must be cut at 50° angles where they meet.
   The ends of strips 1 and 3 must be cut at 15° where they meet.

3. Regular octagons have internal angles with measures that equal 135°. The reflex angle to each of these will have measures equalling 360° – 135° = 225°. The mitre joints will bisect these angles so that the measures of the angles between each piece's ends and the straight sides equal 112.5°.

4. ∠A measures 150°. The bisected angle measures 75°.

   ∠B measures 140°. The bisected angle measures 70°.

   ∠C measures 130°. The bisected angle measures 65°.

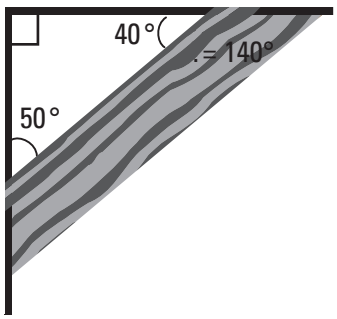
   ∠D measures 130°. The bisected angle measures 65°.

5. The total angle between the left pair of light rays equals 76°. The angle of reflection and the angle of incidence equal 38°.

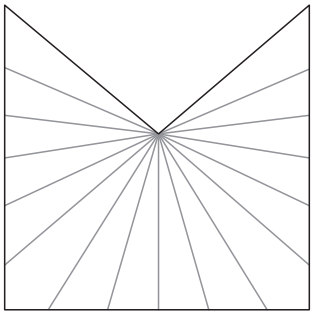
   The total angle between the middle pair of light rays equals 100°. The angle of reflection and the angle of incidence equal 50°.

   The total angle between the right pair of light rays equals 124°. The angle of reflection and the angle of incidence equal 62°.

6. The piece of wood must be cut at a 140° angle. If one angle of a bisected straight line is 40°, the supplementary angle must equal 140°.

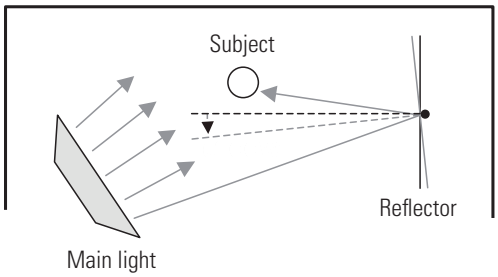


7. Diagrams should look approximately like this.



Extend your thinking

8. The reflector must be rotated 6° counter-clockwise.



5.3 NON-PARALLEL LINES AND TRANSVERSALS

BUILD YOUR SKILLS, PAGE 204

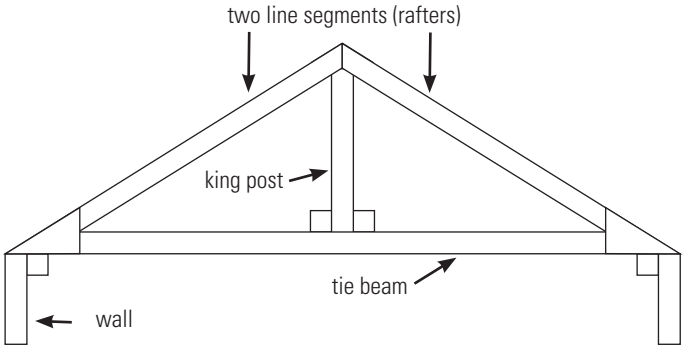
1. a) Angle 6 is vertically opposite to angle 1. Both have a measure of 81°.

   b) Angle 5 is the alternate exterior angle to angle 4. No, their measures are not equal.

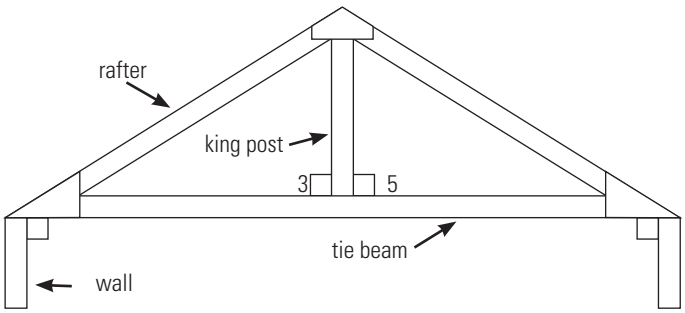
   c) Angle 8 is the corresponding angle to angle 6. No, their measures are not equal.

   d) Angle 3 is the other interior angle on the same side of the transversal in the pair formed with angle 2. No, these angles are not supplementary.

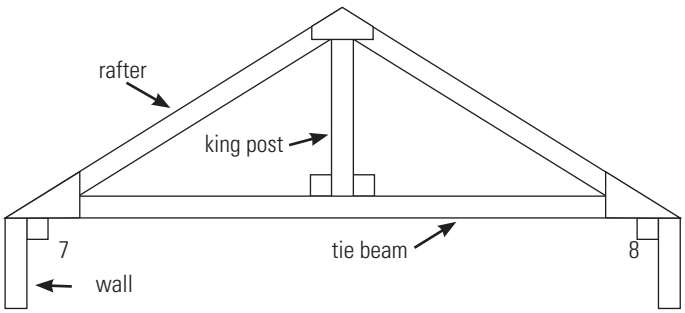
2. a) The king post is the transversal, because it intersects with both the left and right rafter.



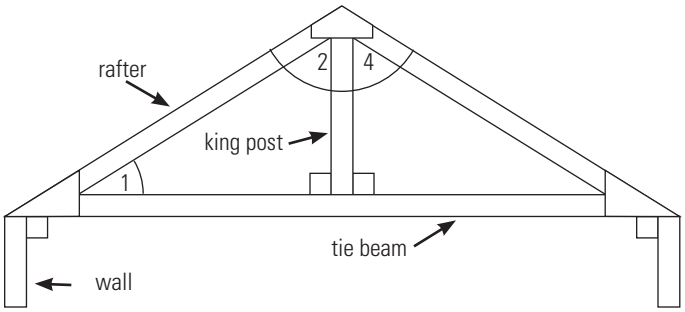
   b) Angles 3 and 5 are supplementary angles. They are two right angles that equal 180° when combined.



   c) Angles 7 and 8 are interior angles on the same side of a transversal. The sum of their measures equals 180°.



d) If angles 1, and 2 and 4 combined are interior angles on the same side of a transversal, then the two main line segments would be the right rafter and the tie beam, and the transversal would be the left rafter.



3. a) The seat and the runner are the main line segments. The transversal is the main support and back.

b) Angles 1 and 2 are alternate interior angles.

c) $\angle 1 = 78°$

$\angle 2 = 85°$

Extend your thinking

4. a) i) $\angle 1 = 90°$

$\angle 2 = 90°$

$\angle 3 = 45°$

Angle 1 is greater than angle 3.

ii) Angles 2 and 3 are not supplementary angles because they do not equal 180°.

b) i) $\angle 1 = 45°$

$\angle 2 = 135°$

$\angle 3 = 45°$

Angle 1 equals angle 3.

ii) Angles 2 and 3 are supplementary angles because they equal 180°.

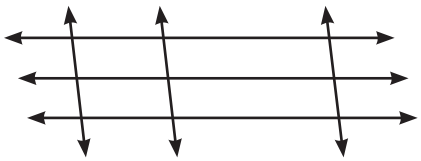
c) i) Corresponding angles for parallel lines have equal measures, whereas corresponding angles for non-parallel line segments do not.

ii) Interior angles on the same side of the transversal for parallel lines are supplementary angles. Interior angles on the same side of the transversal for non-parallel lines are not supplementary angles.

5.4 PARALLEL LINES AND TRANSVERSALS

BUILD YOUR SKILLS, PAGE 214

1.



2. Answers will vary. One way is to ensure that the tracks are an equal distance apart. Another way is to ensure that the rail ties always form supplementary interior angles on the same side of the transversal formed by the rails.

3. The first diagram contains parallel lines, but the second diagram does not.

a) Use a ruler to confirm that the distance between the lines is the same throughout, or measure angles by drawing a transversal and determining that alternate interior or corresponding angles are equal.

b) Use a ruler to confirm that the distance between lines is not constant.

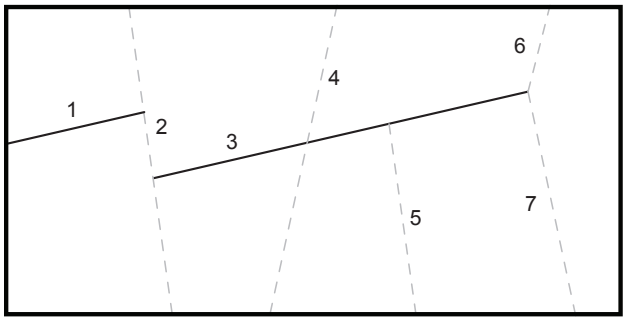
4. $x = 75°$ because it is an interior angle on the same side of the transversal with the 105° angle and together they must equal 180°.

5. The top and bottom faces are parallel.

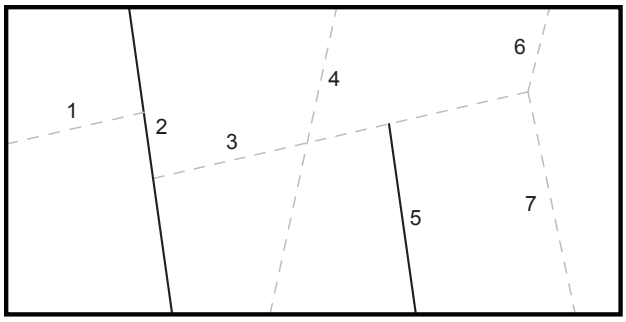
   The front and back faces are not parallel.

6. The boat operator must adjust her boat's heading 8° to starboard.

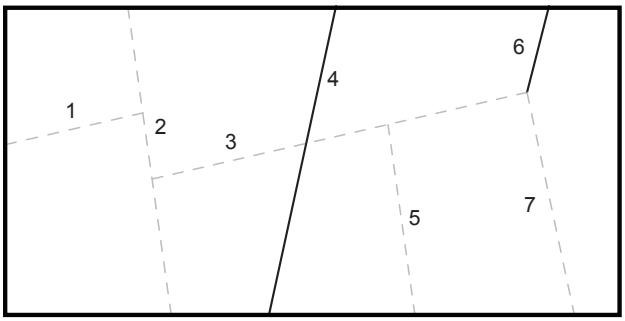
7. Line segments 1 and 3 are parallel. Using 2 as the transversal, there are two equal alternate interior angles that both measure 85°.



Line segments 2 and 5 are parallel. Using 3 as the transversal, there are two angles on the same side of the transversal that are supplementary (95° + 85° = 180°).



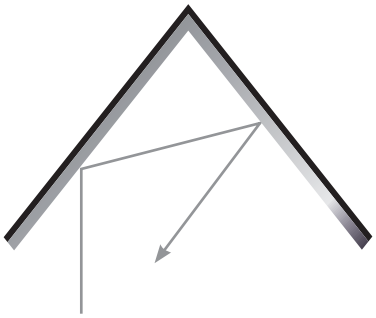
Line segments 4 and 6 are also parallel. Using 3 as the transversal they have two corresponding angles that both measure 115°.



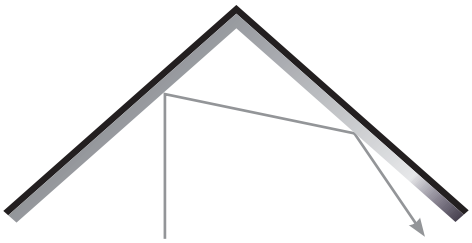
Extend your thinking

8. a) Answers will vary. Mirrors can be attached to plywood sheets that are joined so that they are perpendicular. L-shaped metal braces could be attached to the backs.

   b) If the angle measure is less than 90°, the reflected ray will intersect the incident ray. Reflections could be distorted, or unseen by the viewer.

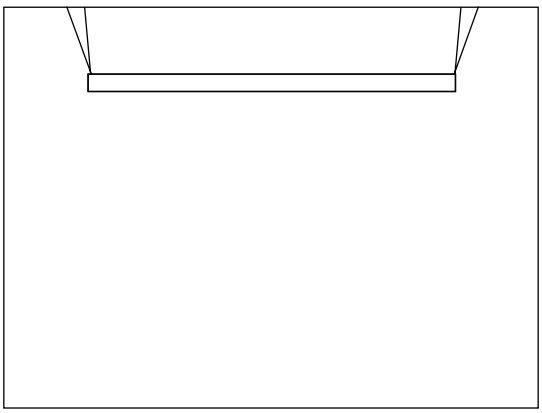


c) If the angle measure is greater than 90°, the reflected ray will diverge from the incident ray. Reflections could be distorted, or be unseen by the viewer.

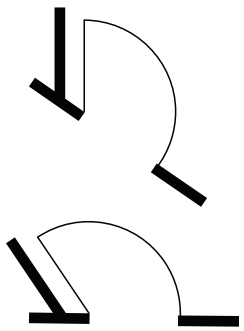


PRACTISE YOUR NEW SKILLS, PAGE 220

1.



2. The diagrams should look like those below.

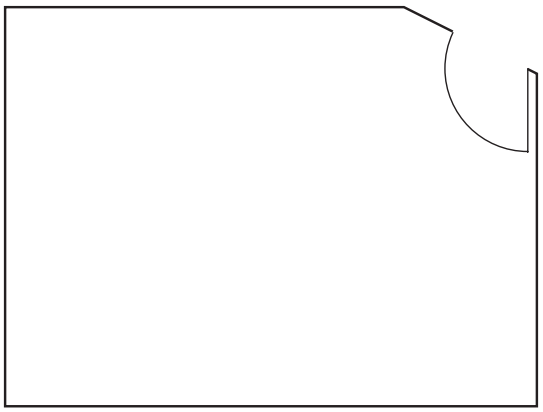


3. Leg 1 is approximately 30° (the sailboat's current position to the first buoy).

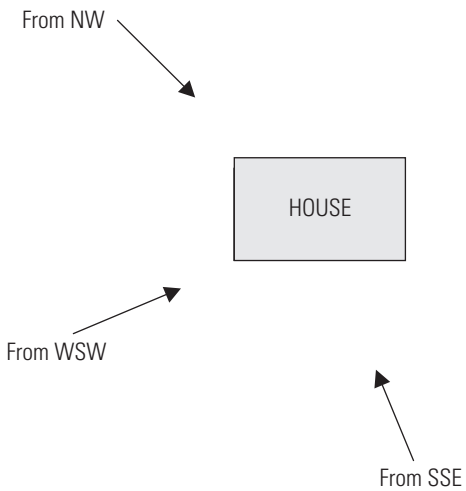
   Leg 2 is approximately 83° (first buoy to the second).

   Leg 3 is approximately 250° (second buoy to other boat).

4. The fifth wall is approximately 4 feet long. It makes a 153° angle with the top wall and a 117° with the right wall.



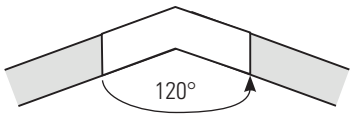
5. The west- facing and south-facing sides will get the most wind, so they should be the ones to get the 3-pane windows.



6. a) The measures of the top angles in each window frame are 35°. The measure of each bottom angle is 55°.

   b) The measures of the angles at each end of the window frame section are 17.5° (at the top), 45° (at the right-angle vertex), and 27.5° at the remaining vertex.

7. Students should have created a template of a similar shape to the gusset shown in the diagram, with 120° angles in the centre.

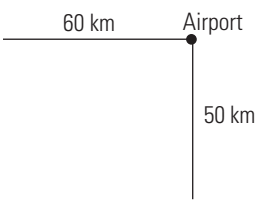


8. a) Studs 2 and 3 are perpendicular to the wall plates. (Studs 1 and 4 are not.)

   b) Studs 2 and 3 are parallel to the left end of the wall. Let the bottom wall plate be the transversal of the studs. The interior angles on the same side of the transversal between the left end of the wall and studs 2 and 3 are supplementary, making them parallel to the left end. The interior angles on the same side of the transversal between the left end of the wall and studs 1 and 4 are not supplementary, so studs 1 and 4 are not parallel to the left end of the wall.

9. a) The aircraft travelling west will travel 60 km, while the one travelling south will travel 50 km.

   b)



   The bearing of the southbound aircraft relative to the westbound aircraft is 220°.

CHAPTER 6
SIMILARITY OF FIGURES
6.1 SIMILAR POLYGONS

BUILD YOUR SKILLS, PAGE 232

1. a) The side lengths will be doubled and the angle measurements will stay the same.

   b) The side lengths will be tripled and the angle measurements will stay the same.

   c) The side lengths will be halved and the angle measurements will stay the same.

2. Statement c is correct.

3. The two figures are not similar because they do not have the same shape. Their angles measures are not the same.

4. Plots similar to Plot A: Plots D and J

   Plots similar to Plot B: Plots E, I, and K

   Plots similar to Plot C: Plots F, G, H, L

5. Painting A is similar. Painting B is not similar.

   Calculate the ratios of the lengths and widths of the paintings and the frames to determine if they are similar.

   Painting A

$$\frac{\text{frame length}}{\text{painting length}} = \frac{120}{80}$$
$$\frac{\text{frame length}}{\text{painting length}} = 1.5$$

$$\frac{\text{frame width}}{\text{painting width}} = \frac{120}{80}$$
$$\frac{\text{frame width}}{\text{painting width}} = 1.5$$

Painting B

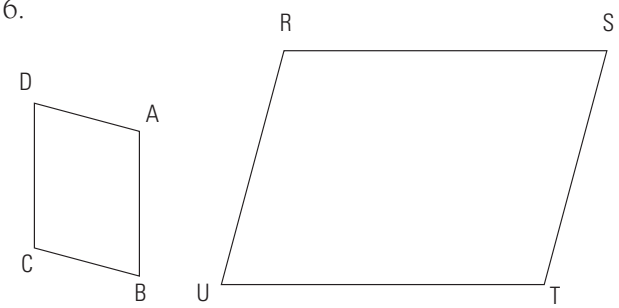
$$\frac{\text{frame length}}{\text{painting length}} = \frac{160}{120}$$

$$\frac{\text{frame length}}{\text{painting length}} = 1.3$$

$$\frac{\text{frame width}}{\text{painting width}} = \frac{120}{180}$$

$$\frac{\text{frame width}}{\text{painting width}} = 1.5$$

6.



Corresponding angles: A and R, B and S, C and T, and D and U.

Corresponding sides: AB and RS, BC and ST, CD and TU, and AD and RU.

Extend your thinking

7. Point F: (–7, –6)

   Point G: (5, –6)

   Point H: (5, 2)

6.2. DETERMINING IF TWO POLYGONS ARE SIMILAR

BUILD YOUR SKILLS, PAGE 243

1. a) The scale factor used was $\frac{1}{3}$.

   b) $x = 2$ cm

2. a) Side AB corresponds to EF

   Side BC corresponds to FG

   Side CD corresponds to GH

   Side AD corresponds to EH

   b) The scale factor used was $\frac{1}{3}$.

   c) BC has a length of 24 cm.

   d) Angle D measures 125°.

   e) Angle L measures 55°. Angle L corresponds to angle C. The measure of angle C is equal to the measure of A. That means that angle L and angle A also have the same measure.

3. Fiona might not be right, because she may not have compared the corresponding sides. If the corresponding sides were 6:4, 9:6, and 12:8, the second triangle would be 1.5 times the size of the first triangle and could be a scaled copy.

4. The width of the larger rectangle is 5.4 inches.

5. The two triangles are similar figures.

   Marco can prove his answer to his boss by comparing the lengths of the corresponding sides and determining that they are proportional.

6. a) Yes, they are similar. The side lengths are proportional and the angles are congruent.

b) Lise can use a scale factor of $\frac{25}{50}$ or 0.5.

c) Lise can write the scale factor as $\frac{50}{25}$ or 2.

7. a) Lance's statement is correct. Squares have 4 equal sides. So when one side is resized using a scale factor, all sides must be increased by the same number to keep the shape a square.

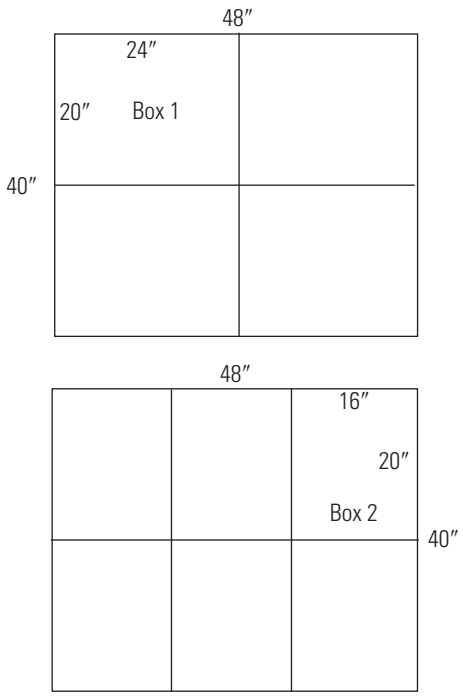
b) Max's statement is incorrect because rectangles will have two pairs of sides with equal side lengths, but the two pairs do not need to be resized by the same number to keep the shape of a rectangle.

8. Yes, casserole A is similar to casserole C.

If casserole A is similar to casserole B, then each side was multiplied by the same factor. If casserole B is similar to casserole C, then each side was multiplied by the same factor. That means that each side of casserole A could be multiplied by some number that would result in the length of casserole C.

Extend your thinking

9. a)



b) Box 1 is similar to the pallet shape with a scale factor of one-half. Compare the dimensions of Box 1.

$$\frac{24}{48} = \frac{1}{2}$$
$$\frac{20}{40} = \frac{1}{2}$$

Box 2 is not similar to the pallet shape. Compare the dimensions of Box 2.

$$\frac{20}{48} = 0.417$$
$$\frac{16}{40} = 0.40$$

c) The ratio of areas is 0.25.

The area of the pallet is 1920 in^2.

The area of the similar box is 480 in^2.

$$\frac{480}{1920} = 0.25 \text{ or } \frac{1}{4}$$

The ratio of areas equals the square of the ratio of sides, that is,

$$\frac{1}{4} = \frac{1}{2} \times \frac{1}{2}$$

Area = length × width

Area factor = length factor × width factor

For similar shapes,

length factor = width factor = scale factor

scale factor = length factor × width factor

area factor = scale factor × scale factor.

6.3 DRAWING SIMILAR POLYGONS

BUILD YOUR SKILLS, PAGE 252

1. a) Both Nipin and Francis are correct. Nipin has found the scale factor used on M to create R. Francis has found the scale factor used on R to create M.

   b) Answers will vary. To fully answer this question, students will need to draw a rectangle on graph paper where the length and width have a ratio of $\frac{1}{2}$. Students will then need to determine the scale factor used to create their new rectangle.

2. a) Answers will vary.

   b) To fully answer this question, students will need to draw a rectangle where the length and width do not have a ratio of $\frac{2}{3}$.

3. Each rectangle will have dimensions of 1 unit by 2 units.

4. The perimeter of the smaller pentagon is 10 cm. The perimeter of the larger pentagon is 20 cm. The new pentagon's perimeter is $\frac{1}{2}$ of the larger pentagon's perimeter.

5. The scale factor used was $\frac{1}{3}$. Angle measurements will be the same.

   $a = 70°$

   $b = 110°$

   $c = 4.4 \text{ cm} \times \frac{1}{3}$

   $c = 1.5 \text{ cm}$

   $d = 3 \text{ cm} \times \frac{1}{3}$

   $d = 1 \text{ cm}$

   $e = 4.2 \text{ cm} \times \frac{1}{3}$

   $e = 1.4 \text{ cm}$

6. The living room has dimensions of 22.5 feet by 30 feet.

Extend your thinking

7. The value of x plus 2 must be 2 units longer than x. The side lengths of 6 and 8 give a difference of 2, so the value of x is 6 and the value of x plus 2 is 8.

6.4 SIMILAR TRIANGLES

BUILD YOUR SKILLS, PAGE 261

1. Set 1:
   Yes, they are similar.

   Table 1: 90°, 45°, 45°

   Table 2: 45°, 45°, 90°

   Set 2:
   No, they are not similar.

   Table 1: 133°, 11°, 36°

   Table 2: 35°, 11°, 134°

2. Side AB measures 11.25 inches.

3. Side EC measures approximately 2.38 inches.

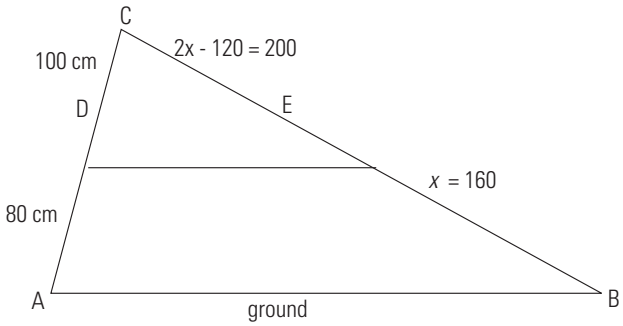
4. The height of the mountain is 1788 ft above Tryna's position.

5. Side x equals 12.

Extend your thinking

6. $x = 160$

   BC = 360 cm



PRACTISE YOUR NEW SKILLS, PAGE 265

1. a) new width = 16 cm

   new length = 24 cm

   b) new width = 30 cm

   new length = 45 cm

   c) new width = 6 cm

   new length = 9

   d) new width = 20 cm

   new length = 30 cm

2. a) The ratio of any corresponding sides will be $\frac{3}{4}$.

   b) The ratio is 1.

3. a) The scale factor is $\frac{1}{4}$.

   b) a = 1.25

   b = 0.25

   c = 0.25

   c) Bill does not need to know length e because the given angles and dimensions define the shape.

4. a) Reduce the large drawer's dimensions by one half to find the answer.

   middle drawer width = 40 cm

   middle drawer height = 16 cm

   b) Reduce the middle drawer by 50% to find the answer.

   small drawer width = 20 cm

   small drawer height = 8 cm

   c) The scale factor of the smallest drawer from the biggest drawer is 0.25 or $\frac{1}{4}$.

$$\text{scale factor} = \frac{\text{small drawer height}}{\text{large drawer height}}$$

$$\text{scale factor} = \frac{8\text{ cm}}{32\text{ cm}}$$

$$\text{scale factor} = \frac{1}{4}$$

   d) The dresser height is 114 cm.

   Dresser height = (2 × large height) + (2 × middle height) + small height + feet

   Dresser height = (2 × 32) + (2 × 16) + 8 + 10

   Dresser height = 114 cm

5. a) A scale factor of two was used.

   b) $a = 103°$, $b = 90°$, $c = 12.5$ m, $d = 51.3$ m

   c) $e = 90°$, $f = 77°$, $g = 48$ m

6. The poster is approximately 36 inches wide and 48 inches long, so these dimensions will satisfy the customer.

   57 inches reduces to 35.625 inches.

   76 inches reduces to 47.5 inches.

7. No. Her rectangle would have to have dimensions of 4 times 3, which would give an area of 12 cm^2, not 24 cm^2.

8. Yes, the triangles are similar because they each have angle measures of 85°, 32°, and 63°.

9. The two triangles are similar.

   Two triangles are similar if one angle is congruent and the two sides adjacent to the congruent angle are in the same proportion.

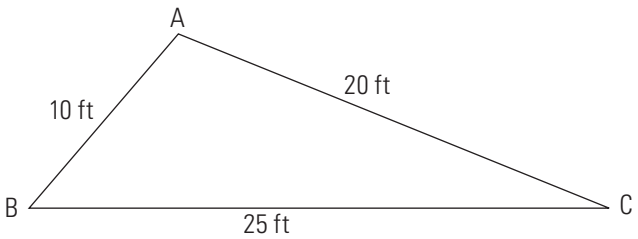
   Angle B ~ Angle F

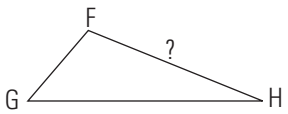
   $$AB \sim ED$$
   $$\frac{AB}{FH} = \frac{5.5}{13.75}$$
   $$\frac{AB}{FH} = 0.4$$

   $$BC \sim FG$$
   $$\frac{BC}{FG} = \frac{3.3}{8.25}$$
   $$\frac{BC}{FG} = 0.4$$

   The ratio of $\frac{AB}{FH}$ and $\frac{BC}{FG}$ are both 0.4. Therefore the triangles are similar.

10. Side FH is 8 feet long.





The triangles are similar.

$$\frac{AB}{FG} = 2.5$$

Therefore,

$$\frac{AC}{FH} = 2.5$$
$$\frac{20}{FH} = 2.5$$
$$20 = 2.5 \times FH$$
$$\frac{20}{2.5} = FH$$
$$8 \text{ ft} = FH$$

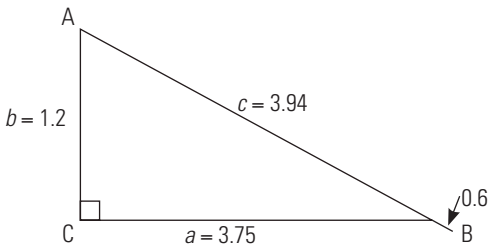
CHAPTER 7
TRIGONOMETRY OF RIGHT TRIANGLES
7.1 THE PYTHAGOREAN THEOREM

BUILD YOUR SKILLS, PAGE 278

1. a) AC is 2.3 m high.

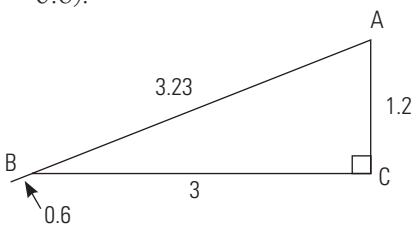
   b) AE is 4.2 m long.

2. a) Each rafter is 4.5 m long.

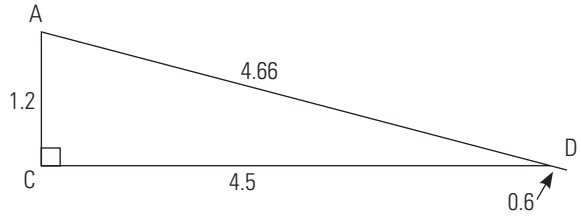


   b) The rafters will be 3.83 m and 5.26 m long.

   The shorter rafter is 3.83 m long (3.23 + 0.6).



The longer rafter is 5.26 m long (4.66 + 0.6).



3. Suzanne will need 1028 cm or 10.28 m of wire. She should buy a little extra wire because some numbers in the calculation were rounded down.

4. a) They need 2485 cm or 24.85 m of wire.

   b) Guy wires increase a structure's stability.

5. a) The diameter must be 45 mm because the answer must be a multiple of five.

   b) The diameter must be 1.25″.

6. a) 57 m

   b) Air shafts are legislated so that fresh air comes into the mines for the safety of the workers.

7. a) Each sloping roof piece will be 1.13 m long.

   b) The height of the doghouse will be 0.8 m long.

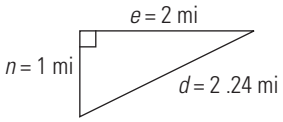
   c) The doghouse will be 0.4 m high.

   d) No, this doghouse would not be suitable for a large dog because there would not be enough room for it to move around.

Extend your thinking

8 The new route is 0.76 miles shorter.

The new route is 2.24 miles and the old route is three miles because 3 minus 2.24 equals 0.76.



9. a) Sara is wrong because she took the square root of each figure in the Pythagorean theorem. To calculate correctly, she must take the square root of each side.

   b) Sara should have bought 15 m of ribbon.

10. Yes, Jim could have built a box whose sides were not perpendicular to the base. If they angled outward, he would have to be sure that they had enough support and wouldn't fall outward. If they angled inward, he would have the same type of problem —they couldn't angle inward too much in case of falling inward. He would also have to ensure that the opening was big enough so that the toys would fit in.

11. Harpreet will need 47 paving blocks.

12. a) The hill is approximately 462 m high.

    b) John would not likely be able to measure the horizontal distance in one measurement so he would have to break the hill up into parts.

    Also, he would get a different result if he measured along the hill because the hill is steeper at different sections. However, if he were able to measure the straight distance (see diagram) from the bottom to the top, along with the horizontal distance, he would get the same result.

13. No. Fermat's Last Theorem states that there are no such numbers. He initially stated this in 1637, but it remained unproven, albeit there were many tries to do so, until 1995.

7.2 THE SINE RATIO

BUILD YOUR SKILLS, PAGE 289

1. sin 16° = 0.2756

   sin 28° = 0.4695

   sin 51° = 0.7771

   sin 83° = 0.9925

2. a) Diagram 1: sin X = 0.5

   Diagram 2: sin X = 0.6

   Diagram 3: sin X = 0.4

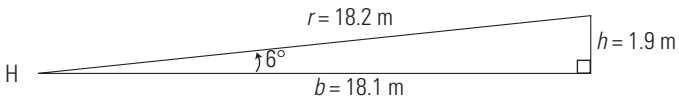
   b) Diagram 1 slide is 5.2 m long.

   Diagram 2 slide is 4.3 m long.

   Diagram 3 slide is 6 m long.

3. a) Each tipi pole is approximately 16 ft long.

4. a) The ramp must be 18.2 m long.

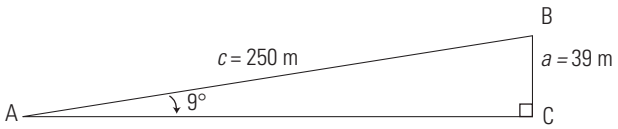


   b) The ramp will start about 18.1 m from the base of the porch.

   c) If the ramp were too steep, the person in the wheelchair might not have control.

5. He will need about 95.9 m^2 of roofing.

6. a) The road rises about 39 m.



   b) In road construction, this is considered a steep road.

7. a) 161 m

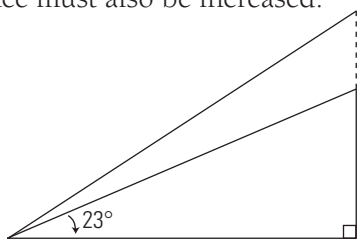
   b) 190 m

8. a) length of low side = 56.1 m

   b) length of high side = 57 m

Extend your thinking

9. Both the length of the rafter and the vertical distance will increase. Suppose the angle is increased and the width stays the same, the height must be greater, and then the angular distance must also be increased.



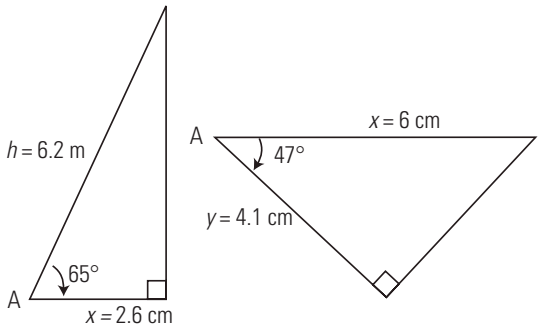
10. Zero is less than sin x which is less than 1. That is, since the sine is defined as the ratio of the side opposite an acute angle to the hypotenuse, if the angle is very small, the opposite side is very small, and the ratio is close to zero, but if the angle is close to 90°, the opposite side is close in length to the hypotenuse and the ratio would be close to 1.

7.3 THE COSINE RATIO

BUILD YOUR SKILLS, PAGE 297

1. a) $x = 2.6$ m

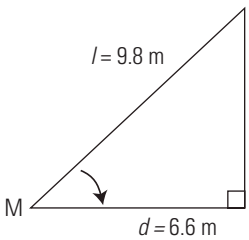
   b) $x = 6$ cm



2. The travel pipe must be 83.1 m long.
3. The wires are 38.1 m and 47.7 m long.
4. The surveyor is 217.3 m from the top of the second building.
5. The timber reaches 5.6 ft up the pole.
6. The length of the tapered section of the kayak is 2.8 ft.

Extend your thinking

7. If the opposite and the adjacent sides of a triangle are equal, the triangle must be isosceles and so the angles must be 45°. In this case, sin x equals cos x.
8. The mount is approximately 6.6 m from the post.



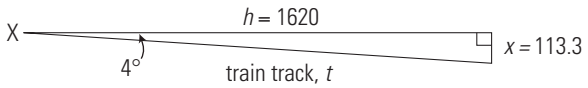
9. The radius measures 3.4 cm.

   The measure of x is 1.7 cm. Therefore, 1 chord equals 1.7 cm and the other equals 2.3 cm.

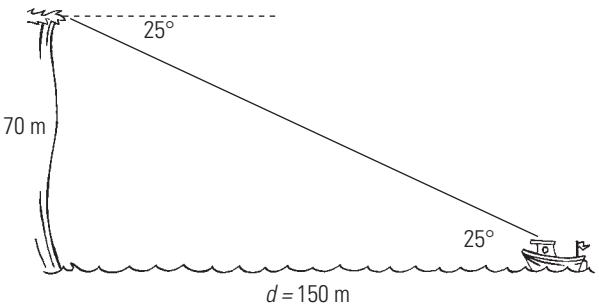
7.4 THE TANGENT RATIO

BUILD YOUR SKILLS, PAGE 305

1. The difference in elevation is 113.3 m.

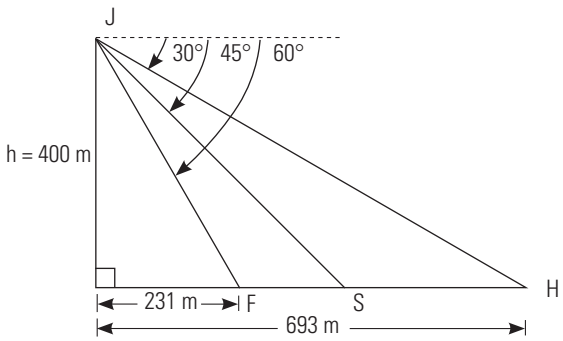


2. The helicopter was 466 m above ground.
3. a) The height of the cliff is 0.466 of the distance to the boat.



   b) The boat is 150 m from the cliff.

4. The maximum banner height is 43.5 m.
5. a) His house is farthest away.



b) The farthest building is 693 m away.

c) The closest object is the field house, which is 231 m away.

6. a) The CSI needs to know at what height from the ground the bullet was shot.

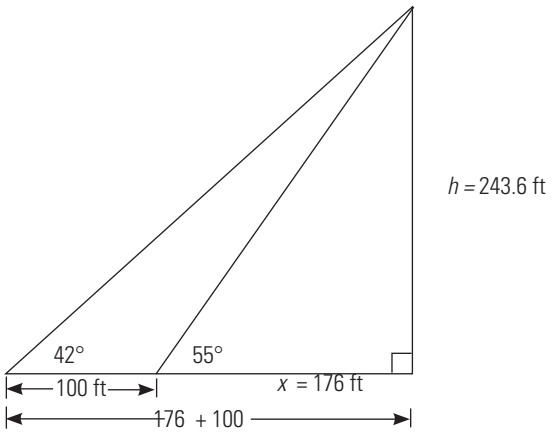
b) He was about 19.5 m from the wall.

c) No.

7. The tree is about 7 m tall.

Extend your thinking

8. The centre is 243.6 ft tall.



7.5 FINDING ANGLES AND SOLVING RIGHT TRIANGLES

BUILD YOUR SKILLS, PAGE 311

1. a) $t = 7.43$ cm

$\angle R = 20°$

$\angle S = 70°$

b) $\angle M = 32°$

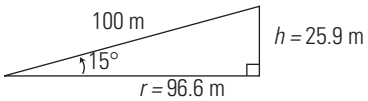
$l = 5.3$ in

$m = 3.3$ in

2. a) You would gain 25.9 m.

b) You would cover 96.6 m.

c) The grade is 26.8%.



3. a) The angle of elevation is 34°.

b) The total shingled area is 864 ft^2.

4. a) The crane's arm must be 15.3 m long.

b) The angle of elevation is 58°.

5. a) The angle of elevation is 53°.

b) The ladder is 9 m from the base of the apartment.

6. a) The angle of depression is 19°.

7. a) The helicopter rose approximately 254.4 m in 3 minutes.

b) The helicopter's speed was 84.8 m/min, or 1.4 m/sec.

8. The angle of elevation is 8°.

Extend your thinking

9. a) The total distance between the pipes is 5.4 m.

b) The pipe fitter will need 7.3 m of pipe to get around the obstruction.

c) The pipe fitter would have to be more accurate. He could round to the nearest centimetre.

PRACTISE YOUR NEW SKILLS, PAGE 316

1. a) No.

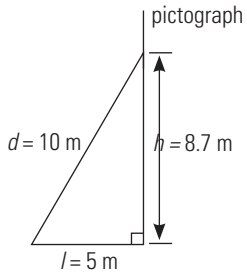
   b) No.

   c) Yes.

   d) Yes.

   e) No.

2. The pictographs are 8.7 m up the cliff.

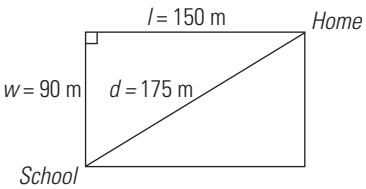


3. a) Sarbjit will save 65 m if he takes the shortcut.

   Add the length plus the width of the field to get 240 m.

   To calculate the amount of distance Sarbjit will save, subtract the shortcut distance from the figure above.

   240 - 175 = 65

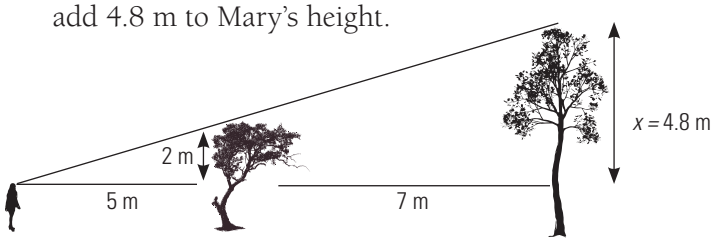


   b) Answers will vary.

4. a) You gain approximately 174 m in altitude.

   b) The change in altitude would be less because the rise would have to decrease as the angle decreased for the same distance along the road.

5. To calculate the height of the second tree, add 4.8 m to Mary's height.



   The second tree is 6.3 m tall.

6. The lake is 260 m long.

7. a) The vertical height is 2.5 m.

   b) The support pieces are approximately 2.1 m long.

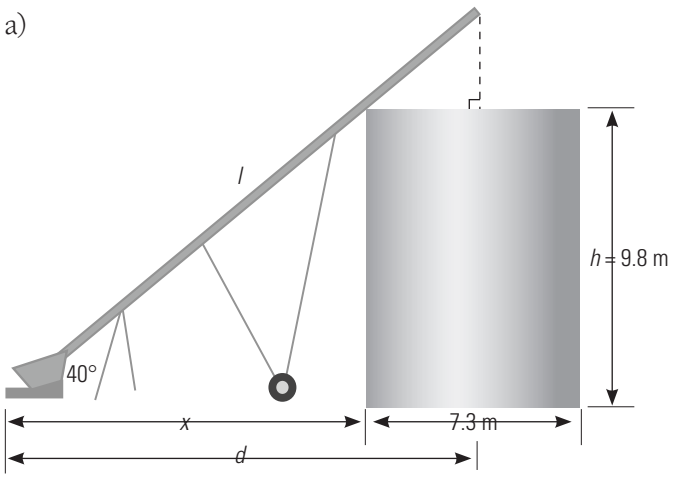
   c) The rafter is approximately 4.7 m long.

8. a) The pit is 215.8 m deep.

   b) The surveyor would need to know the shape of the pit, how long the pit was, or if it were circular or oval. Then he could find the volume of the pit to determine the amount of gravel removed.

9. The angle of depression is 67°.

10. a)

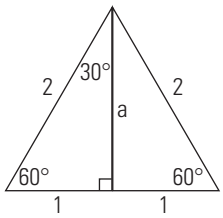


b) The auger is 20.1 m long.

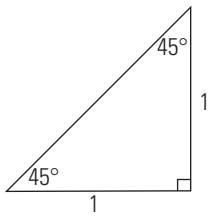
11. The grade would be zero.

12. The Burj Dubai is approximately 820 m tall.

13. These are "special triangles." If one angle of a right triangle is 60°, then the other is 30°. Using the Pythagorean theorem, Katarina could solve any right triangle with a 60° angle.



Similarly, for a right triangle with a 45° angle, she could use the following diagram.



The two legs of the triangle will be equal and she can solve any right triangle with a 45° angle using the Pythagorean theorem.