Mathematics 2201
Unit 3: Acute Triangle Trigonometry
Unit Assessment

Name:_____

Section 1: Selected Response   (28 points)
Circle the letter of the most correct answer.

1.   Solve for the unknown side length. Round your answer to one decimal place. $\dfrac{q}{\sin 30°} = \dfrac{10.0}{\sin 80°}$

   a. 20.3
   b. 5.0
   c. 5.1
   d. 0.5

2. Solve for the unknown angle measure. Round your answer to the nearest degree. $\dfrac{15.2}{\sin H} = \dfrac{12.0}{\sin 50°}$
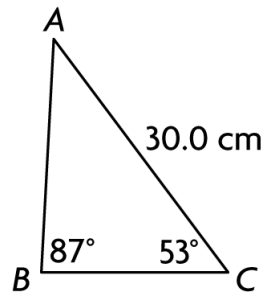
   a. 77°
   b. 76°
   c. 75°
   d. 74°

3. What information do you need to know about an acute triangle to use the sine law?

   a. two angles and any side
   b. two sides and any angle
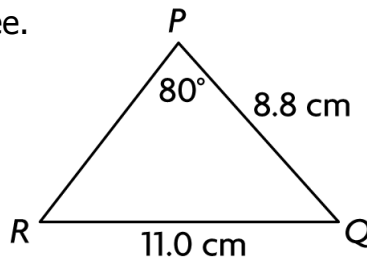   c. all the sides
   d. all the angles

4. Determine the length of c to the nearest tenth of a centimetre.

   a. 26.1 cm
   b. 24.0 cm
   c. 25.0 cm
   d. 23.0 cm

5. Determine the measure of $<R$ to the nearest degree.

   a. 56°
   b. 54°
   c. 52°
   d. 50°

6. In triangle DEF, $<D = 61°$, $d = 23.9$ cm, and $<E = 38°$.
    Determine the length of side e to the nearest tenth of a centimetre.

   a. 18.4 cm
   b. 17.6 cm
   c. 16.0 cm
   d. 16.8 cm

7. In triangle DEF, $d = 10.0$ cm, $e = 8.6$ cm, and $<E = 45°$.
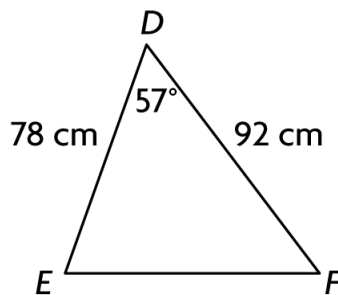   Determine the measure of $<D$ to the nearest degree.

   a. 65°
   b. 35°
   c. 55°
   d. 45°

8. What information do you need to know about an acute triangle to use the cosine law?

    a. two angles and any side
    b. two sides and any angle
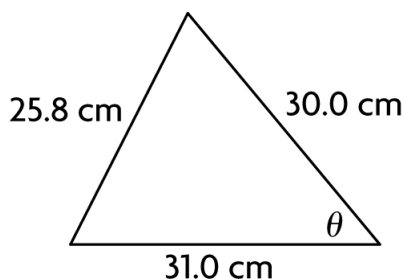   c. all the sides
    d. all the angles

9. Determine the length of *EF* to the nearest centimetre.

    a. 88 cm
    b. 84 cm
    c. 86 cm
    d. 82 cm

10. Determine the measure of θ to the nearest degree.

    a. 50°
    b. 40°
    c. 30°
    d. 60°

11. In triangle *DEF*, *d* = 13.5 cm, *e* = 18.2 cm, and <*F* = 60°.
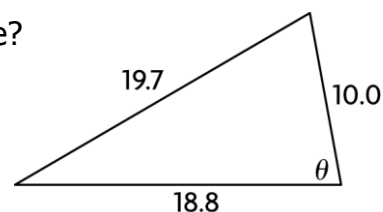   Determine the measure of *f* to the nearest tenth of a centimetre.

    a. 17.0 cm
    b. 16.8 cm
    c. 16.4 cm
    d. 16.6 cm

12. In triangle *DEF*, *d* = 23.9 cm, *e* = 16.8 cm, and *f* = 27.0 cm.
    Determine the measure of <*D* to the nearest degree.

    a. 61°
    b. 64°
    c. 58°
    d. 54°
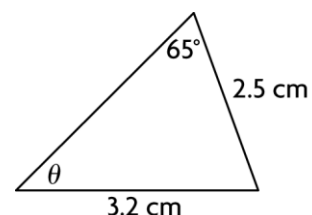
13. How you would determine the indicated angle measure, if it is possible?

    a. the cosine law
    b. primary trigonometric ratios
    c. the sine law
    d. not possible

14. How you would determine the indicated angle measure, if it is possible?

    a. not possible
    b. primary trigonometric ratios
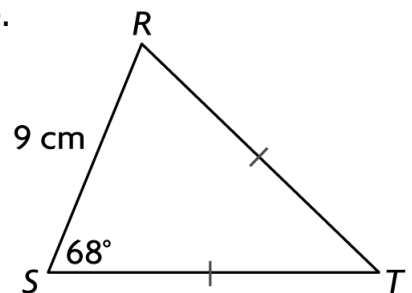   c. the cosine law
    d. the sine law

1. In a parallelogram, two adjacent sides measure 8.4 cm and 7.2 cm. The shorter diagonal is 10.5 cm. Determine, to the nearest degree, the measures of the larger angles in the parallelogram.

2. In triangle PQR, $<P = 55°$, $<Q = 77°$, and $p = 4.5$ cm.
   Solve the triangle. Round angles to the nearest degree and sides to the nearest tenth of a centimetre. Show your work.

3. A radio tower is supported by two wires on opposite sides. On the ground, the ends of the wire are 280 m apart. One wire makes a 60° angle with the ground. The other makes a 66° angle with the ground.

   Draw a diagram of the situation. Then, determine the length of each wire to the nearest metre. Show your work.

4. Determine, to the nearest centimetre, the perimeter of the triangle.

dfpogkjsdpr
Answer Section

MULTIPLE CHOICE

1. ANS: D   PTS: 1   DIF: Grade 11   REF: Lesson 3.1
   OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
   reasoning.   TOP: Side-angle relationships in acute triangles
   KEY: primary trigonometric ratios
2. ANS: C   PTS: 1   DIF: Grade 11   REF: Lesson 3.1
   OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
   reasoning.   TOP: Side-angle relationships in acute triangles
   KEY: primary trigonometric ratios
3. ANS: A   PTS: 1   DIF: Grade 11   REF: Lesson 3.1
   OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
   reasoning.   TOP: Side-angle relationships in acute triangles
   KEY: primary trigonometric ratios
4. ANS: B   PTS: 1   DIF: Grade 11   REF: Lesson 3.1
   OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
   reasoning.   TOP: Side-angle relationships in acute triangles
   KEY: primary trigonometric ratios
5. ANS: C   PTS: 1   DIF: Grade 11   REF: Lesson 3.1
   OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
   reasoning.   TOP: Side-angle relationships in acute triangles
   KEY: primary trigonometric ratios
6. ANS: A   PTS: 1   DIF: Grade 11   REF: Lesson 3.2
   OBJ: 3.2 Explain the steps in a given proof of the sine law or cosine law.
   TOP: Proving and applying the sine law   KEY: sine law
7. ANS: B   PTS: 1   DIF: Grade 11   REF: Lesson 3.2
   OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
   reasoning.   TOP: Proving and applying the sine law   KEY: sine law
8. ANS: B   PTS: 1   DIF: Grade 11   REF: Lesson 3.2
   OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
   reasoning.   TOP: Proving and applying the sine law   KEY: sine law
9. ANS: A   PTS: 1   DIF: Grade 11   REF: Lesson 3.2
   OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
   reasoning.   TOP: Proving and applying the sine law   KEY: sine law
10. ANS: C   PTS: 1   DIF: Grade 11   REF: Lesson 3.2
    OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
    reasoning.   TOP: Proving and applying the sine law   KEY: sine law
11. ANS: C   PTS: 1   DIF: Grade 11   REF: Lesson 3.2
    OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
    reasoning.   TOP: Proving and applying the sine law   KEY: sine law
12. ANS: A   PTS: 1   DIF: Grade 11   REF: Lesson 3.2
    OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
    reasoning.   TOP: Proving and applying the sine law   KEY: sine law
13. ANS: C   PTS: 1   DIF: Grade 11   REF: Lesson 3.2
    OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the

reasoning. TOP: Proving and applying the sine law KEY: sine law
14. ANS: D PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law
15. ANS: A PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law
16. ANS: A PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law
17. ANS: D PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law
18. ANS: C PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law
19. ANS: D PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law
20. ANS: D PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law
21. ANS: C PTS: 1 DIF: Grade 11 REF: Lesson 3.3
OBJ: 3.2 Explain the steps in a given proof of the sine law or cosine law.
TOP: Proving and applying the cosine law KEY: cosine law
22. ANS: D PTS: 1 DIF: Grade 11 REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the cosine law
KEY: cosine law
23. ANS: A PTS: 1 DIF: Grade 11 REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the cosine law
KEY: cosine law
24. ANS: C PTS: 1 DIF: Grade 11 REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the cosine law
KEY: cosine law
25. ANS: A PTS: 1 DIF: Grade 11 REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the cosine law
KEY: cosine law
26. ANS: A PTS: 1 DIF: Grade 11 REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the cosine law
KEY: cosine law
27. ANS: B PTS: 1 DIF: Grade 11 REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the cosine law
KEY: cosine law

28. ANS: B	PTS: 1	DIF: Grade 11	REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Proving and applying the cosine law
KEY: cosine law
29. ANS: C	PTS: 1	DIF: Grade 11	REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Proving and applying the cosine law
KEY: cosine law
30. ANS: A	PTS: 1	DIF: Grade 11	REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Proving and applying the cosine law
KEY: cosine law
31. ANS: A	PTS: 1	DIF: Grade 11	REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Proving and applying the cosine law
KEY: cosine law
32. ANS: A	PTS: 1	DIF: Grade 11	REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Proving and applying the cosine law
KEY: cosine law
33. ANS: A	PTS: 1	DIF: Grade 11	REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Proving and applying the cosine law
KEY: cosine law
34. ANS: B	PTS: 1	DIF: Grade 11	REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Proving and applying the cosine law
KEY: cosine law
35. ANS: D	PTS: 1	DIF: Grade 11	REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Proving and applying the cosine law
KEY: cosine law
36. ANS: A	PTS: 1	DIF: Grade 11	REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Solving problems using acute triangles
KEY: sine law| cosine law| primary trigonometric ratios
37. ANS: D	PTS: 1	DIF: Grade 11	REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Solving problems using acute triangles
KEY: sine law| cosine law| primary trigonometric ratios
38. ANS: D	PTS: 1	DIF: Grade 11	REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Solving problems using acute triangles
KEY: sine law| cosine law| primary trigonometric ratios
39. ANS: A	PTS: 1	DIF: Grade 11	REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.	TOP: Solving problems using acute triangles
KEY: sine law| cosine law| primary trigonometric ratios
40. ANS: D	PTS: 1	DIF: Grade 11	REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the

reasoning. TOP: Solving problems using acute triangles
KEY: sine law| cosine law| primary trigonometric ratios
41. ANS: A PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles
KEY: sine law| cosine law| primary trigonometric ratios
42. ANS: A PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles
KEY: sine law| cosine law| primary trigonometric ratios
43. ANS: C PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles KEY: cosine law
44. ANS: D PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Solving problems using acute triangles KEY: sine law| cosine law
45. ANS: A PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Solving problems using acute triangles
KEY: sine law
46. ANS: C PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Solving problems using acute triangles
KEY: sine law
47. ANS: A PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles
KEY: sine law| primary trigonometric ratios
48. ANS: D PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles
KEY: sine law| primary trigonometric ratios
49. ANS: D PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles KEY: cosine law
50. ANS: C PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a

contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles   KEY: cosine law

SHORT ANSWER

51. ANS:
23.2

PTS: 1   DIF: Grade 11   REF: Lesson 3.1
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.   TOP: Side-angle relationships in acute triangles
KEY: primary trigonometric ratios

52. ANS:
46°

PTS: 1   DIF: Grade 11   REF: Lesson 3.1
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.   TOP: Side-angle relationships in acute triangles
KEY: primary trigonometric ratios

53. ANS:
38°

PTS: 1   DIF: Grade 11   REF: Lesson 3.1
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.   TOP: Side-angle relationships in acute triangles
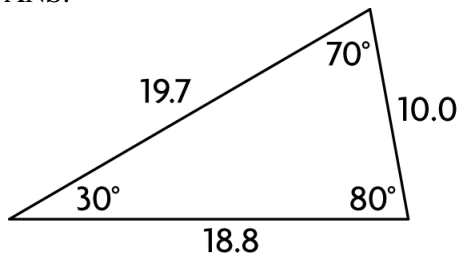KEY: primary trigonometric ratios

54. ANS:

70°, 18.8

PTS: 1   DIF: Grade 11   REF: Lesson 3.1
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a
contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Side-angle relationships in acute triangles   KEY: primary trigonometric ratios

55. ANS:

70°, 33.2

PTS: 1 DIF: Grade 11 REF: Lesson 3.1
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
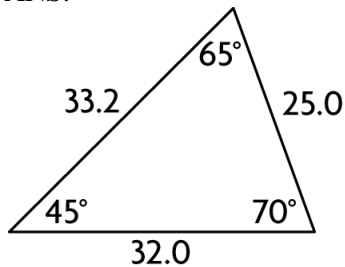TOP: Side-angle relationships in acute triangles KEY: primary trigonometric ratios

56. ANS:
For example, knowing either the value of t or $\angle S$ would allow me to solve for the other. Then I could determine the value of $\angle R$ and solve for r.

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.2 Explain the steps in a given proof of the sine law or cosine law. TOP: Proving and applying the sine law
KEY: sine law

57. ANS:
For example, determine the measure of $\angle M$ using the fact that the sum of the angles in a triangle add up to 180°.

Then calculate $m = \sin N \dfrac{m}{\sin M}$.

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.2 Explain the steps in a given proof of the sine law or cosine law. TOP: Proving and applying the sine law
KEY: sine law

58. ANS:
$c = 42.7$ cm

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

59. ANS:
$e = 7.2$ cm

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

60. ANS:
$d = 6.2$ cm

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

61. ANS:
$\theta = 57°$

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

62. ANS:
$\theta = 53°$

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

63. ANS:
$\alpha = 69°$

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

64. ANS:
$c = 24.5$ cm

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

65. ANS:
$c = 23.0$ cm

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

66. ANS:
$h = 33.0$ cm

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

67. ANS:
$\angle S = 41°$

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

68. ANS:
$\angle T = 71°$

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

69. ANS:
$\angle L = 48°$

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

70. ANS:
$\angle Q = 51°$

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the

reasoning.   TOP: Proving and applying the sine law   KEY: sine law
71. ANS:
For example, knowing the length of *b* or the measure of $\angle B$ would allow me to solve the triangle.

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.2 Explain the steps in a given proof of the sine law or cosine law.
TOP: Proving and applying the cosine law   KEY: cosine law
72. ANS:
$s^2 = q^2 + r^2 - 2qr \cos S$

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.2 Explain the steps in a given proof of the sine law or cosine law.
TOP: Proving and applying the cosine law   KEY: cosine law
73. ANS:
$$\cos W = \frac{x^2 + y^2 - w^2}{2xy}$$

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.2 Explain the steps in a given proof of the sine law or cosine law.
TOP: Proving and applying the cosine law   KEY: cosine law
74. ANS:
$w = 27.3$ cm

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.   TOP: Proving and applying the cosine law
KEY: cosine law
75. ANS:
$d = 10.0$ cm

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.   TOP: Proving and applying the cosine law
KEY: cosine law
76. ANS:
$s = 45.9$ cm

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.   TOP: Proving and applying the cosine law
KEY: cosine law
77. ANS:
$\theta = 57°$

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the

reasoning.　　　　　TOP: Proving and applying the cosine law
KEY: cosine law
78. ANS:
$\alpha = 67°$

PTS: 1　　　　　DIF: Grade 11　　REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.　　　　　TOP: Proving and applying the cosine law
KEY: cosine law
79. ANS:
$\alpha = 53°$

PTS: 1　　　　　DIF: Grade 11　　REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.　　　　　TOP: Proving and applying the cosine law
KEY: cosine law
80. ANS:
$h = 24.0$ cm

PTS: 1　　　　　DIF: Grade 11　　REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.　　　　　TOP: Proving and applying the cosine law
KEY: cosine law
81. ANS:
$r = 12.9$ cm

PTS: 1　　　　　DIF: Grade 11　　REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.　　　　　TOP: Proving and applying the cosine law
KEY: cosine law
82. ANS:
$t = 93.5$ cm

PTS: 1　　　　　DIF: Grade 11　　REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.　　　　　TOP: Proving and applying the cosine law
KEY: cosine law
83. ANS:
$\angle V = 56°$

PTS: 1　　　　　DIF: Grade 11　　REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.　　　　　TOP: Proving and applying the cosine law
KEY: cosine law
84. ANS:
$\angle C = 73°$

PTS: 1　　　　　DIF: Grade 11　　REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.　　　　　TOP: Proving and applying the cosine law

KEY: cosine law
85. ANS:
$\angle D = 62°$

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.   TOP: Proving and applying the cosine law
KEY: cosine law
86. ANS:
The measures of two sides and an angle opposite one of the sides are given, so use the sine law to solve for θ.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.   TOP: Solving problems using acute triangles
KEY: sine law
87. ANS:
The lengths of three sides are given, so use the cosine law to solve for θ.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.   TOP: Solving problems using acute triangles
KEY: cosine law
88. ANS:
The measures of two sides and the contained angle are given, so use the cosine law to solve for x.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.   TOP: Solving problems using acute triangles
KEY: cosine law
89. ANS:
There is not enough information to determine the measure of y.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.   TOP: Solving problems using acute triangles
KEY: sine law| cosine law
90. ANS:
The measures of one sides and two angles are given, so use the sine law to solve for x.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the
reasoning.   TOP: Solving problems using acute triangles
KEY: sine law
91. ANS:
Since the measures of two sides and a contained angle are given, I would use the cosine law.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a
contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Solving problems using acute triangles   KEY: cosine law

92. ANS:
Since the triangle that represents this situation is a right triangle and the measures of one side and one angle are given, I would use primary trigonometric ratios.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Solving problems using acute triangles   KEY: primary trigonometric ratios

93. ANS:
3.3 km

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Solving problems using acute triangles   KEY: cosine law

94. ANS:
0.5 km

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Solving problems using acute triangles   KEY: primary trigonometric ratios

95. ANS:
30′4″

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.   TOP: Solving problems using acute triangles
KEY: sine law

96. ANS:
28′11″

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.   TOP: Solving problems using acute triangles
KEY: sine law

97. ANS:
217.0 m

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles
KEY: sine law| primary trigonometric ratios

98. ANS:
284.4 m

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a

contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a
contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles
KEY: sine law| primary trigonometric ratios

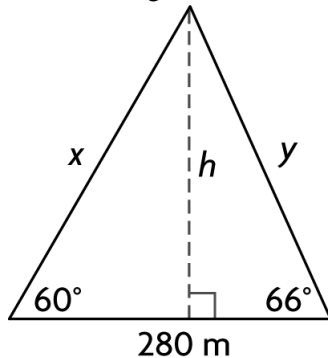99. ANS:
96°

PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a
contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a
contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles KEY: cosine law
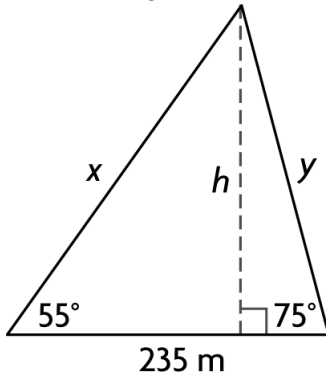
100. ANS:
140°

PTS: 1 DIF: Grade 11 REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a
contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a
contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles KEY: cosine law

PROBLEM

101. ANS:
$$\angle P + \angle Q + \angle R = 180°$$
$$55° + 77° + \angle R = 180°$$
$$\angle R = 48°$$

$$\frac{r}{\sin R} = \frac{p}{\sin P}$$

$$\frac{r}{\sin 48°} = \frac{4.5}{\sin 55°}$$

$$\sin 48° \left(\frac{r}{\sin 48°} \right) = \sin 48° \left(\frac{4.5}{\sin 55°} \right)$$

$$r = 4.082\ldots$$

The length of r is 4.1 cm.

$$\frac{q}{\sin Q} = \frac{p}{\sin P}$$

$$\frac{q}{\sin 77°} = \frac{4.5}{\sin 55°}$$

$$\sin 77° \left(\frac{q}{\sin 77°} \right) = \sin 77° \left(\frac{4.5}{\sin 55°} \right)$$

$$q = 5.352\ldots$$

The length of q is 5.4 cm.

PTS: 1 DIF: Grade 11 REF: Lesson 3.2

OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the sine law   KEY: sine law

102.   ANS:

$$\frac{\sin V}{v} = \frac{\sin U}{u}$$

$$\frac{\sin V}{7.6} = \frac{\sin 60°}{8.7}$$

$$7.6\left(\frac{\sin V}{7.6}\right) = 7.6\left(\frac{\sin 60°}{8.7}\right)$$

$$\angle V = \sin^{-1}(0.7565...)$$

$$\angle V = 49.159...°$$

The measure of $\angle V$ is 49°.

$$\angle T + \angle U + \angle V = 180°$$
$$\angle T + 60° + 49° = 180°$$
$$\angle T = 71°$$

$$\frac{t}{\sin T} = \frac{u}{\sin U}$$

$$\frac{t}{\sin 71°} = \frac{8.7}{\sin 60°}$$

$$\sin 71°\left(\frac{t}{\sin 71°}\right) = \sin 71°\left(\frac{8.7}{\sin 60°}\right)$$

$$t = 9.498...$$

The length of t is 9.5 m.

PTS: 1   DIF: Grade 11   REF: Lesson 3.2
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the sine law   KEY: sine law

103.   ANS:
Let the x and y be the length of the wires.
The third angle is $180° - 66° - 60° = 54°$.

Use the sine law to determine the length of each wire:

$$\frac{x}{\sin 66°} = \frac{280}{\sin 54°} \qquad \frac{y}{\sin 60°} = \frac{280}{\sin 54°}$$

$$x = \frac{280 \sin 66°}{\sin 54°} \qquad x = \frac{280 \sin 60°}{\sin 54°}$$

$$= 316.177\ldots \qquad = 299.730\ldots$$

The wires are 316 m and 300 m long.

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the sine law KEY: sine law| primary trigonometric ratios
104. ANS:
Let the x and y be the length of the wires.
The third angle is $180° - 55° - 75° = 50°$.

Use the sine law to determine the length of each wire:

$$\frac{x}{\sin 75°} = \frac{235}{\sin 50°} \qquad \frac{y}{\sin 55°} = \frac{235}{\sin 50°}$$

$$x = \frac{235 \sin 75°}{\sin 50°} \qquad y = \frac{235 \sin 55°}{\sin 50°}$$

$$x = 296.317\ldots \qquad y = 251.291\ldots$$

The wires are 296 m and 251 m long.

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the sine law KEY: sine law| primary trigonometric ratios
105. ANS:
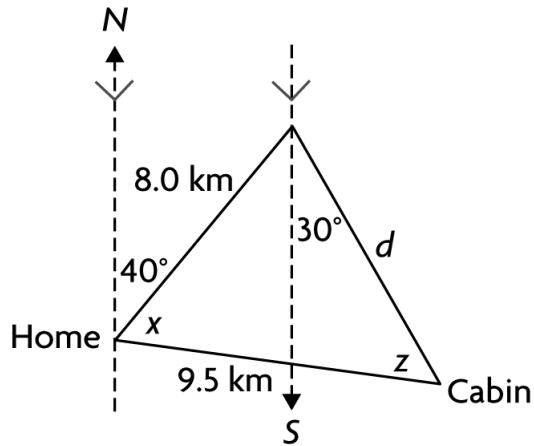
Because the lines are parallel, the angle beside the 30° angle is also 40°.
The entire angle is 70°.

$$\frac{\sin z}{8.0} = \frac{\sin 70°}{9.5}$$

$$8.0\left(\frac{\sin z}{8.0}\right) = 8.0\left(\frac{\sin 70°}{9.5}\right)$$

$$z = \sin^{-1}(0.7913\ldots)$$

$$z = 52.3090\ldots°$$

$$x + 70° + z = 180°$$

$$x + 70° + 52.309\ldots° = 180°$$

$$x = 57.690\ldots°$$

$$\frac{d}{\sin x} = \frac{9.5}{\sin 70°}$$

$$\frac{d}{\sin 57.690\ldots°} = \frac{9.5}{\sin 70°}$$

$$d = 8.544\ldots$$

Stella travelled 8.5 km.

PTS: 1   DIF: Grade 11   REF: Lesson 3.2
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the sine law   KEY: sine law

106. ANS:
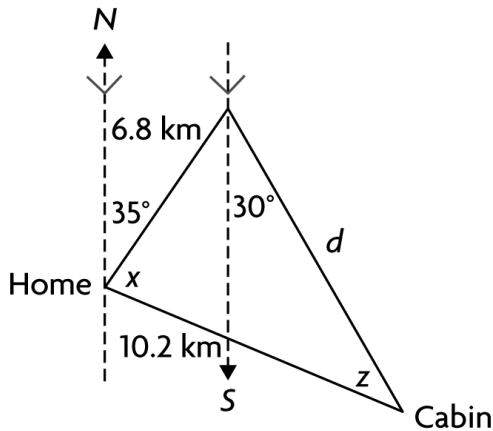
Because the lines are parallel, the angle beside the 30° angle is also 35°.
The entire angle is 65°.

$$\frac{\sin z}{6.8} = \frac{\sin 65^\circ}{10.2}$$

$$6.8\left(\frac{\sin z}{6.8}\right) = 6.8\left(\frac{\sin 65^\circ}{10.2}\right)$$

$$z = \sin^{-1}(0.6042\ldots)$$

$$z = 37.171\ldots^\circ$$

$$x + 65^\circ + z = 180^\circ$$

$$x + 65^\circ + 37.171\ldots^\circ = 180^\circ$$

$$x = 77.828\ldots^\circ$$

$$\frac{d}{\sin x} = \frac{10.2}{\sin 65^\circ}$$

$$\frac{d}{\sin 77.828\ldots} = \frac{10.2}{\sin 65^\circ}$$

$$d = 11.001\ldots$$

Max travelled 11.0 km.

PTS: 1   DIF: Grade 11   REF: Lesson 3.2
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the sine law   KEY: sine law

107. ANS:
Let $\angle C$ represent the measure of the remaining unknown angle.

$$\angle A + \angle B + \angle C = 180^\circ$$

$$64^\circ + 48^\circ + \angle C = 180^\circ$$

$$\angle C = 68^\circ$$

Let b represent the distance from tower A to the fire.

$$\frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{b}{\sin 48°} = \frac{4.2}{\sin 68°}$$

$$b = \sin 48°\left(\frac{4.2}{\sin 68°}\right)$$

$$b = 3.366\ldots$$

The distance from tower *A* to the fire is 3.4 km.

Let *a* represent the distance from tower *B* to the fire.

$$\frac{a}{\sin A} = \frac{c}{\sin C}$$

$$\frac{a}{\sin 64°} = \frac{4.2}{\sin 68°}$$

$$a = \sin 64°\left(\frac{4.2}{\sin 68°}\right)$$

$$a = 4.071\ldots$$

The distance from tower *B* to the fire is 4.1 km.

PTS: 1 DIF: Grade 11 REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. TOP: Proving and applying the sine law KEY: sine law

108. ANS:
Let $\angle C$ represent the measure of the remaining unknown angle.

$$\angle A + \angle B + \angle C = 180°$$
$$55° + 64° + \angle C = 180°$$
$$\angle C = 61°$$

Let *b* represent the distance from tower *A* to the fire.

$$\frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{b}{\sin 64°} = \frac{2.5}{\sin 61°}$$

$$b = \sin 64°\left(\frac{2.5}{\sin 61°}\right)$$

$$b = 2.569\ldots$$

The distance from tower *A* to the fire is 2.6 km.
Let *a* represent the distance from tower *B* to the fire.

$$\frac{a}{\sin A} = \frac{c}{\sin C}$$

$$\frac{a}{\sin 55°} = \frac{2.5}{\sin 61°}$$

$$a = \sin 55°\left(\frac{2.5}{\sin 61°}\right)$$

$$a = 2.341\ldots$$

The distance from tower *B* to the fire is 2.3 km.

PTS: 1   DIF: Grade 11   REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.   TOP: Proving and applying the sine law   KEY: sine law

109. ANS:
Determine the measure of $\angle N$.

$$\angle L + \angle M + \angle N = 180°$$
$$80° + 50° + \angle N = 180°$$
$$\angle N = 50°$$

ΔLMN is isosceles because $\angle M = \angle N$.
So, $m = 14$ cm because it is also opposite a 50° angle.

Determine the length of *l*.

$$\frac{l}{\sin L} = \frac{m}{\sin M}$$

$$\frac{l}{\sin 80°} = \frac{14}{\sin 50°}$$

$$l = \sin 80°\left(\frac{14}{\sin 50°}\right)$$

$$l = 17.998\ldots$$

Perimeter $= l + m + n$
Perimeter $= 17.998\ldots + 14 + 14$
Perimeter $= 45.998\ldots$
The perimeter is 46 cm.

PTS: 1   DIF: Grade 11   REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.   TOP: Proving and applying the sine law   KEY: sine law

110. ANS:
Since ΔRST is isosceles, $\angle R = \angle S$ and $r = s$.
Determine the measure of $\angle T$.

$$\angle R + \angle S + \angle T = 180°$$
$$68° + 68° + \angle T = 180°$$
$$\angle T = 44°$$

Determine the length of *r*.

$$\frac{r}{\sin R} = \frac{t}{\sin T}$$

$$\frac{R}{\sin 68°} = \frac{9}{\sin 44°}$$

$$r = \sin 68°\left(\frac{9}{\sin 44°}\right)$$

$$r = 12.012...$$

Perimeter $= r + s + t$

Perimeter $= 12.012... + 12.012... + 9$

Perimeter $= 33.025...$

The perimeter is 33 cm.

PTS: 1   DIF: Grade 11   REF: Lesson 3.2
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.   TOP: Proving and applying the sine law   KEY: sine law

111. ANS:

$$t^2 = u^2 + v^2 - 2uv \cos T$$
$$6.0^2 = 7.6^2 + 8.0^2 - 2(7.6)(8.0) \cos T$$
$$36.0 = 57.76 + 64.00 - 121.60 \cos T$$
$$-85.76 = -121.60 \cos T$$
$$\frac{-85.76}{-121.60} = \cos T$$
$$\angle T = \cos^{-1}(0.7052...)$$
$$\angle T = 45.149...°$$

The measure of $\angle T$ is 45°.

$$u^2 = t^2 + v^2 - 2tv \cos U$$
$$7.6^2 = 6.0^2 + 8.0^2 - 2(6.0)(8.0) \cos U$$
$$57.76 = 36.00 + 64.00 - 96.00 \cos U$$
$$-42.24 = -96.00 \cos U$$
$$\frac{-42.24}{-96.00} = \cos U$$
$$\angle U = \cos^{-1}(0.44)$$
$$\angle U = 63.896...°$$

The measure of $\angle U$ is 64°.

$$v^2 = t^2 + u^2 - 2tu \cos V$$
$$8.0^2 = 6.0^2 + 7.6^2 - 2(6.0)(7.6) \cos V$$
$$64.0 = 36.0 + 57.76 - 91.2 \cos V$$
$$-29.76 = -91.2 \cos V$$
$$\frac{-29.76}{-91.2} = \cos V$$
$$\angle V = \cos^{-1}(0.3263...)$$
$$\angle V = 70.954...°$$

The measure of $\angle V$ is 71°.

PTS: 1   DIF: Grade 11   REF: Lesson 3.3

112. ANS:

$$c^2 = a^2 + b^2 - 2ab \cos C$$
$$c^2 = 12.0^2 + 14.0^2 - 2(12.0)(14.0) \cos 62°$$
$$c^2 = 144.0 + 196.0 - 336.0(0.4694...)$$
$$c^2 = 182.257...$$
$$c = 13.500...$$

The length of c is 13.5 cm.

$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$12.0^2 = 14.0^2 + 13.5^2 - 2(14.0)(13.5) \cos A$$
$$144.0 = 196.00 + 182.25 - 378.00 \cos A$$
$$-234.25 = -378.00 \cos A$$
$$\frac{-234.25}{-378.00} = \cos A$$
$$\angle A = \cos^{-1}(0.6197...)$$
$$\angle A = 51.705...°$$

The measure of $\angle A$ is 52°.

$$b^2 = a^2 + c^2 - 2ac \cos B$$
$$14.0^2 = 12.0^2 + 13.5^2 - 2(12.0)(13.5) \cos B$$
$$196.0 = 144.00 + 182.25 - 324.00 \cos B$$
$$-130.25 = -324.00 \cos B$$
$$\frac{-130.25}{-324.00} = \cos B$$
$$\angle B = \cos^{-1}(0.4020...)$$
$$\angle B = 66.296...°$$

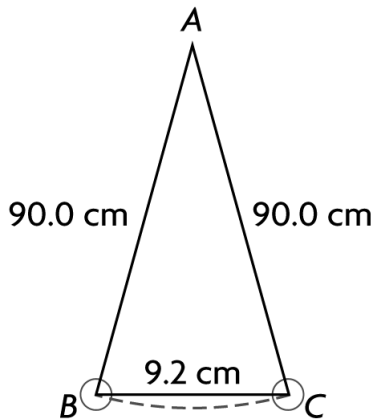The measure of $\angle B$ is 66°.

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the cosine law   KEY: cosine law

113. ANS:
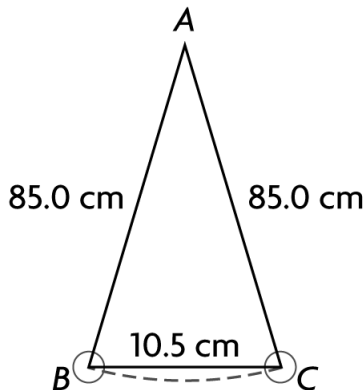
$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$10.5^2 = 85.0^2 + 85.0^2 - 2(85.0)(85.0) \cos A$$

$$110.25 = 7225.00 + 7225.00 - 14\,450.00 \cos A$$
$$-14\,339.75 = -14\,450.00 \cos A$$
$$\frac{-14\,339.75}{-14\,450.00} = \cos A$$
$$\angle A = \cos^{-1}(0.9923...)$$
$$\angle A = 7.082...°$$

The pendulum swings through an angle of 7.1°.

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the cosine law   KEY: cosine law

114. ANS:

$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$9.2^2 = 90.0^2 + 90.0^2 - 2(90.0)(90.0) \cos A$$
$$84.64 = 8100.00 + 8100.00 - 16\,200.00 \cos A$$
$$-16\,115.36 = -16\,200.00 \cos A$$
$$\frac{-16\,115.36}{-16\,200.00} = \cos A$$
$$\angle A = \cos^{-1}(0.9947...)$$
$$\angle A = 5.859...°$$

The pendulum swings through an angle of 5.9°.

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the cosine law   KEY: cosine law

115. ANS:
The shorter diagonal, x, is opposite the smaller angle in a parallelogram. Use the cosine law to determine the length of the diagonal.
$$x^2 = 10^2 + 12^2 - 2(10)(12) \cos 55°$$
$$x^2 = 100 + 144 - 240(0.5735...)$$
$$x^2 = 106.341...$$
$$x = 10.312...$$

The length of the shorter diagonal is 10.3 cm.

PTS: 1   DIF: Grade 11   REF: Lesson 3.3

OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the cosine law   KEY: cosine law

116. ANS:
The shorter diagonal, x, is opposite the smaller angle in a parallelogram.
The measure of the smaller angle is $180° − 105° = 75°$.

Use the cosine law to determine the length of the diagonal.
$$x^2 = 6.5^2 + 9.0^2 − 2(6.5)(9.0) \cos 75°$$
$$x^2 = 42.25 + 81.00 − 117.00(0.2588...)$$
$$x^2 = 92.968...$$
$$x = 9.642...$$
The length of the shorter diagonal is 9.6 cm.

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
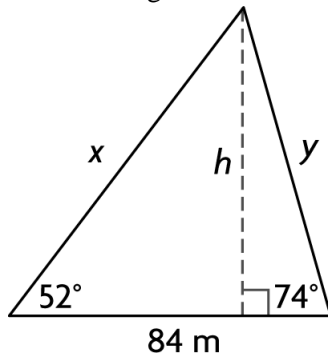OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.   TOP: Proving and applying the cosine law
KEY: cosine law

117. ANS:
After 2 h, the plane travelling at 375 km/h has gone 750 km and the plane travelling at 420 km/h has gone 840 km.
In a triangle that models the information, the unknown angle θ, is opposite the 1000 km side.

$$1000^2 = 750^2 + 840^2 − 2(750)(840) \cos \theta$$
$$1\ 000\ 000 = 562\ 500 + 705\ 600 − 1\ 260\ 000 \cos \theta$$
$$−268\ 100 = −1\ 260\ 000 \cos \theta$$
$$\frac{−268\ 100}{−1\ 260\ 000} = \cos \theta$$
$$\theta = \cos^{-1}(0.2127...)$$
$$\theta = 77.714...°$$
The angle between the two airplanes is 78°.

PTS: 1   DIF: Grade 11   REF: Lesson 3.3
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning.
TOP: Proving and applying the cosine law   KEY: cosine law

118. ANS:
After half an hour, the plane travelling at 360 km/h has gone 180 km and the plane travelling at 430 km/h has gone 215 km.
In a triangle that models the information, the unknown angle θ, is opposite the 100 km side.
$$150^2 = 180^2 + 215^2 − 2(180)(215) \cos \theta$$
$$22\ 500 = 32\ 400 + 46\ 225 − 77\ 400 \cos \theta$$
$$−56\ 125 = −77\ 400 \cos \theta$$
$$\frac{−56\ 125}{−77\ 400} = \cos \theta$$
$$\theta = \cos^{-1}(0.7251...)$$
$$\theta = 43.520...°$$
The angle between the two airplanes is 44°.

119. ANS:

$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$a^2 = 3.3^2 + 3.5^2 - 2(3.3)(3.5) \cos 43°$$
$$a^2 = 10.89 + 12.25 - 23.10(0.7313...)$$
$$a^2 = 6.245...$$
$$a = 2.499...$$

Perimeter $= a + b + c$

Perimeter $= 2.499... + 3.3 + 3.5$

Perimeter $= 9.299...$

The perimeter of the triangle is 9.3 cm.

120. ANS:

$$e^2 = d^2 + f^2 - 2df \cos E$$
$$e^2 = 4.5^2 + 5.5^2 - 2(4.5)(5.5) \cos 73°$$
$$e^2 = 20.25 + 30.25 - 49.50(0.2923...)$$
$$e^2 = 36.027...$$
$$e = 6.002...$$

Perimeter $= d + e + f$

Perimeter $= 4.5 + 6.002... + 5.5$

Perimeter $= 16.002...$

The perimeter of the triangle is 16.0 cm.

121. ANS:

Let the x and y be the lengths of the wires and h be the height of the tower.

The third angle is $180° - 52° - 74° = 54°$.

Use the sine law to determine the length of one of the wires:

$$\frac{x}{\sin 74°} = \frac{84}{\sin 54°}$$

$$x = \frac{84 \sin 74°}{\sin 54°}$$

$$x = 99.807...$$

Use the sine ratio to determine the height of the tower:

$$\sin 52° = \frac{h}{x}$$

$$h = x \sin 52°$$

$$h = (99.807...)(0.7880...)$$

$$h = 78.649...$$

The tower is 78.6 m tall.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
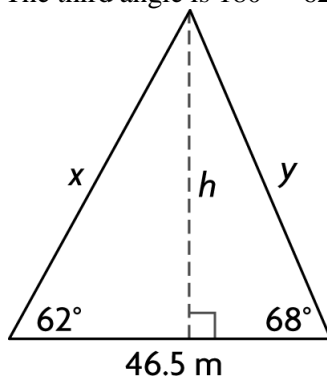TOP: Solving problems using acute triangles
KEY: sine law| primary trigonometric ratios

122. ANS:
Let the x and y be the lengths of the wires and h be the height of the tower.
The third angle is $180° - 62° - 68° = 50°$.

Use the sine law to determine the length of one of the wires:

$$\frac{x}{\sin 68°} = \frac{46.5}{\sin 50°}$$

$$x = \frac{46.5 \sin 68°}{\sin 50°}$$

$$x = 56.281...$$

Use the sine ratio to determine the height of the tower:

$$\sin 62° = \frac{h}{x}$$

$$h = x \sin 62°$$

$$h = (56.281...)(0.8829...)$$

$$h = 49.693...$$

The tower is 49.7 m tall.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles
KEY: sine law| primary trigonometric ratios

123. ANS:

Each sector angle of the regular pentagon is $\dfrac{1}{5}$ of 360°, or 72°.

Let x represent the length of a side of the pentagon.
$x^2 = 8.5^2 + 8.5^2 - 2(8.5)(8.5) \cos 72°$
$x^2 = 72.25 + 72.25 - 144.50(0.3090\ldots)$
$x^2 = 99.847\ldots$
$x = 9.992\ldots$
Perimeter $= 5x$
Perimeter $= 5(9.992\ldots)$
Perimeter $= 49.961\ldots$
The perimeter of the pentagon is 50.0 cm.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles   KEY: cosine law

124. ANS:

Each sector angle of the regular decagon is $\dfrac{1}{10}$ of 360°, or 36°.

Let x represent the length of a side of the decagon.
$x^2 = 6^2 + 6^2 - 2(6)(6) \cos 36°$
$x^2 = 36 + 36 - 72(0.8090\ldots)$
$x^2 = 13.750\ldots$
$x = 3.708\ldots$
Perimeter $= 10x$
Perimeter $= 10(3.708\ldots)$
Perimeter $= 37.082\ldots$
The perimeter of the pentagon is 37.1 m.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles   KEY: cosine law

125. ANS:
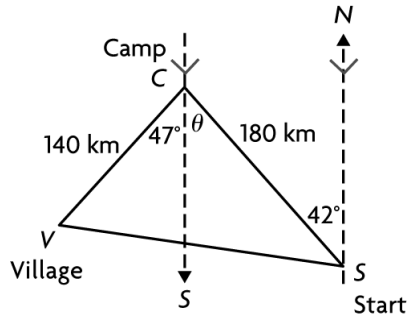
$\theta = 42°$ Alternate interior angles

$\angle C = \theta + 42°$ Property of equality

$\angle C = 42° + 47°$

$\angle C = 89°$

$c^2 = s^2 + v^2 - 2sv \cos C$

$c^2 = 140^2 + 180^2 - 2(140)(180) \cos 89°$

$c^2 = 19\ 600 + 32\ 400 - 50\ 400(0.01745\ldots)$

$c^2 = 51\ 120.398\ldots$

$c = 226.098\ldots$

Total distance $= s + v + c$

Total distance $= 140 + 180 + 226.098\ldots$

Total distance $= 546.098\ldots$

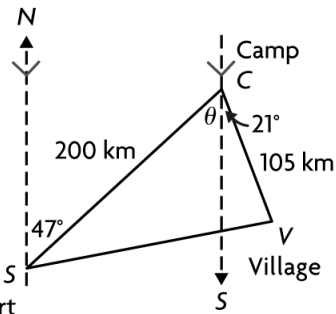The pilot has flown 546 km in total.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4

OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.

TOP: Solving problems using acute triangles   KEY: cosine law

126. ANS:

$\theta = 47°$ Alternate interior angles

$\angle C = \theta + 21°$ Property of equality

$\angle C = 47° + 21°$

$\angle C = 68°$

$c^2 = s^2 + v^2 - 2sv \cos C$

$c^2 = 105^2 + 200^2 - 2(105)(200) \cos 68°$

$c^2 = 11\ 025 + 40\ 000 - 42\ 000(0.3746\ldots)$

$c^2 = 35\ 291.523\ldots$

$c = 187.860\ldots$

Total distance $= s + v + c$

Total distance $= 105 + 200 + 187.860\ldots$

Total distance = 492.860…
The pilot has flown 493 km in total.

PTS: 1　　　　DIF: Grade 11　　REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles　　　　　　KEY: cosine law

127. ANS:

$AD^2 = AB^2 + BD^2 - 2AB{\cdot}BD \cos ABD$
$AD^2 = 6.4^2 + 7.0^2 - 2(6.4)(7.0) \cos 50°$
$AD^2 = 40.96 + 49.00 - 89.60(0.6427…)$
$AD^2 = 32.366…$
$AD = 5.689…$

$\angle BDC = 180° - 48° - 73°$
$\angle BDC = 59°$

$$\frac{BC}{\sin BDC} = \frac{CD}{\sin CBD}$$

$$\frac{BC}{\sin 59°} = \frac{5.5}{\sin 48°}$$

$$BC = \frac{5.5 \sin 59°}{\sin 48°}$$

$$BC = 6.343…$$

Perimeter = $AB + BC + CD + DA$
Perimeter = 6.4 + 6.3438… + 5.5 + 5.689…
Perimeter = 23.932…
The perimeter of *ABCD* is 23.9 cm.

PTS: 1　　　　DIF: Grade 11　　REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles　　　　　　KEY: sine law| cosine law

128. ANS:

$EF^2 = EH^2 + FH^2 - 2EH{\cdot}FH \cos EHF$
$EF^2 = 71.6^2 + 54.0^2 - 2(71.6)(54.0) \cos 50°$
$EF^2 = 5126.56 + 2916.00 - 7732.80(0.6427…)$
$EF^2 = 3072.011…$
$EF = 55.425…$

$$\frac{FG}{\sin FHG} = \frac{GH}{\sin GFH}$$

$$\frac{FG}{\sin 65°} = \frac{73.5}{\sin 71°}$$

$$FG = \frac{73.5 \sin 65°}{\sin 71°}$$

$$FG = 70.451\ldots$$

Perimeter = *EF* + *FG* + *GH* + *HE*
Perimeter = 55.425… + 70.451… + 73.5 + 71.6
Perimeter = 270.977…
The perimeter of *EFGH* is 271.0 cm.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles   KEY: sine law| cosine law

129. ANS:
The angle between Bayridge and Cherbrook at Allenburg is $61° + 12° = 73°$.
Let *x* represent the distance from Bayridge to Cherbrook.

$x^2 = 1100^2 + 900^2 - 2(1100)(900) \cos 73°$
$x^2 = 1\,210\,000 + 810\,000 - 1\,980\,000(0.2923\ldots)$
$x^2 = 1\,441\,104.024\ldots$
$x = 1200.459\ldots$

$$\text{Duration} = \frac{\text{distance}}{\text{speed}}$$

$$\text{Duration} = \frac{1200.459\ldots}{400}$$

Duration = 3.001…
The duration of the flight is 3 h.

PTS: 1   DIF: Grade 11   REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles   KEY: cosine law

130. ANS:
The angle between Eton Lake and Foxford at Dundalk is $180° - 40° - 75° = 65°$.
Let *x* represent the distance from Eton Lake to Foxford.

$x^2 = 1350^2 + 880^2 - 2(1350)(880) \cos 65°$
$x^2 = 1\,822\,500 + 774\,400 - 2\,376\,000(0.4226\ldots)$
$x^2 = 1\,592\,759.010\ldots$
$x = 1262.045\ldots$

$$\text{Duration} = \frac{\text{distance}}{\text{speed}}$$

Duration $= \dfrac{1262.045...}{450}$

Duration $= 2.804…$

The duration of the flight is 2 h 48 min.

PTS: 1　　　　　　DIF: Grade 11　　REF: Lesson 3.4
OBJ: 3.1 Draw a diagram to represent a problem that involves the cosine law or the sine law. | 3.3 Solve a contextual problem that requires the use of the sine law or cosine law, and explain the reasoning. | 3.4 Solve a contextual problem that involves more than one triangle.
TOP: Solving problems using acute triangles　　　　　　KEY: cosine law