FOMP 10 Final Review Part 1 v1
Answer Section

SHORT ANSWER

1. ANS:
SI system

PTS: 1 DIF: 1-2 OBJ: Section 1.1 NAT: M1
TOP: SI Measurement KEY: SI

2. ANS:
metre

PTS: 1 DIF: 1-2 OBJ: Section 1.1 NAT: M1
TOP: SI Measurement KEY: metre | SI

3. ANS:
inch

PTS: 1 DIF: 1-2 OBJ: Section 1.2 NAT: M1
TOP: Imperial Measurement KEY: imperial | inch

4. ANS:
17 cm

PTS: 1 DIF: 1-2 OBJ: Section 1.1 NAT: M1
TOP: SI Measurement KEY: estimate | perimeter | SI

5. ANS:
centimetre

PTS: 1 DIF: 1-2 OBJ: Section 1.1 NAT: M1
TOP: SI Measurement KEY: estimate | SI

6. ANS:
trundle wheel

PTS: 1 DIF: 1-2 OBJ: Section 1.1 NAT: M1
TOP: SI Measurement KEY: measuring instruments | trundle wheel

7. ANS:
inch

PTS: 1 DIF: 1-2 OBJ: Section 1.2 NAT: M1
TOP: Imperial Measurement KEY: imperial | inch

8. ANS:
30

$$10\ yd \frac{3\ ft}{1\ yd} \frac{12\ in}{1\ ft} \frac{1\ bouquet}{12\ in} = 30\ bouquets$$

PTS: 1 DIF: 1-2 OBJ: Section 1.2 NAT: M1
TOP: Imperial Measurement KEY: conversion | imperial | inch | yard

9. ANS:
9.8 in.

$$25\ cm \frac{1\ in}{2.54\ cm} = 9.8\ in$$

PTS: 1 DIF: 1-2 OBJ: Section 1.3 NAT: M1 | M2
TOP: Converting Between SI and Imperial Systems
KEY: centimetre | conversion | imperial | inch | SI

10. ANS:
8.23 m

$$9\ yd \frac{.9144\ m}{1\ yd} = 8.23\ m$$

PTS: 1 DIF: 1-2 OBJ: Section 1.3 NAT: M1 | M2
TOP: Converting Between SI and Imperial Systems
KEY: conversion | imperial to SI | yards to metres

11. ANS:
3.05 m

$$10\ ft \frac{1\ yd}{3\ ft} \frac{.9144\ m}{1\ yd} = 3.05\ m$$

PTS: 1 DIF: 1-2 OBJ: Section 1.3 NAT: M1 | M2
TOP: Converting Between SI and Imperial Systems
KEY: conversion | imperial to SI | feet to metres

12. ANS:
2.7 ft^2

$$area = 85\ cm * 30\ cm \frac{(1\ in)^2}{(2.54\ cm)^2} \frac{\left(1\ ft\right)^2}{(12\ in)^2} = 2.7\ ft^2$$

PTS: 1 DIF: 1-2 OBJ: Section 2.1 NAT: M1
TOP: Units of Area and Volume KEY: conversion factors | convert SI to imperial

13. ANS:
$SA = 2\pi r^2 + 2\pi rh$

PTS: 1 DIF: 1-2 OBJ: Section 2.2 NAT: M3
TOP: Surface Area KEY: formula | right cylinder | surface area

14. ANS:
1809.6 cm^2

$$SA = 4\pi(12\ cm)^2 = 1809.6\ cm^2$$

PTS: 1 DIF: 1-2 OBJ: Section 2.2 NAT: M3 | AN3
TOP: Surface Area KEY: calculate surface area | SI | sphere

15. ANS:

$V = \frac{1}{3}\pi r^2 h$

PTS: 1 DIF: 1-2 OBJ: Section 2.3 NAT: M3
TOP: Volume KEY: formula | right cone | volume

16. ANS:

201 cm^2

$2\pi * 4\ cm * 8\ cm = 201\ cm^2$

PTS: 1 DIF: 1-2 OBJ: Section 2.2 NAT: M3
TOP: Surface Area
KEY: calculate surface area | problem solving | right cylinder | SI

17. ANS:

2.000

PTS: 1 DIF: 1-2 OBJ: Section 3.1 NAT: M4
TOP: The Tangent Ratio KEY: tangent ratio | calculate a tangent ratio | right triangle

18. ANS:

$\cos A = \frac{\text{length of side adjacent to } \angle A}{\text{length of hypotenuse}}$

PTS: 1 DIF: 1-2 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios KEY: cosine ratio | define the cosine ratio

19. ANS:

0.5878

PTS: 1 DIF: 1-2 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios KEY: sine ratio | calculate a sine ratio

20. ANS:

0.5150

PTS: 1 DIF: 1-2 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios KEY: sine ratio | calculate a sine ratio

21. ANS:

47°

PTS: 1 DIF: 1-2 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios KEY: sine ratio | determine an angle measure

22. ANS:

14°

PTS: 1 DIF: 1-2 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios KEY: sine ratio | determine an angle measure

23. ANS:
$\frac{64}{15}$

PTS: 1 DIF: 1-2 OBJ: Section 4.2 NAT: AN3
TOP: Integral Exponents KEY: integral exponent | order of operations

24. ANS:
$\frac{1}{3}$

PTS: 1 DIF: 1-2 OBJ: Section 4.2 NAT: AN3
TOP: Integral Exponents KEY: exponent laws | zero exponent | negative exponent

25. ANS:
0
=1-1=0

PTS: 1 DIF: 1-2 OBJ: Section 4.2 NAT: AN3
TOP: Integral Exponents KEY: exponent laws | zero exponent

26. ANS:
14

PTS: 1 DIF: 1-2 OBJ: Section 4.3 NAT: AN3
TOP: Rational Exponents KEY: rational exponent

27. ANS:
$264^{\frac{1}{3}}$

PTS: 1 DIF: 1-2 OBJ: Section 4.4 NAT: AN3
TOP: Irrational Numbers KEY: convert radical to power

28. ANS:
$\sqrt{11h}$

PTS: 1 DIF: 1-2 OBJ: Section 4.4 NAT: AN2
TOP: Irrational Numbers KEY: convert power to radical

29. ANS:
a)

$$area = 3.5\ cm \frac{10\ mm}{1\ cm} * 5.5 \frac{10\ mm}{1\ cm} = 1925\ mm^2$$

b)

$$area = 35\ mm \frac{1\ m}{1000\ mm} * 70\ mm \frac{1\ m}{1000\ mm} = 0.00245\ m^2$$

PTS: 1 DIF: 1-2 OBJ: Section 2.1 NAT: M1
TOP: Units of Area and Volume KEY: convert within the SI system

30. ANS:

a) $V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi (2.2)^2 (6.4)$

$V = \pi (10.325\ldots)$

$V = 32.436\ldots$

The volume of the cone is approximately 32.4 cm^3.

b) $V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi (5.8)^3$

$V = \pi (260.149\ldots)$

$V = 816.867\ldots$

The volume of the sphere is approximately 816.9 ft^3.

PTS: 1 DIF: 1-2 OBJ: Section 2.3 NAT: M3 | AN3
TOP: Volume KEY: calculate volume | imperial | right cone | SI | sphere

31. ANS:
opposite

PTS: 1 DIF: 1-2 OBJ: Section 3.1 NAT: M4
TOP: The Tangent Ratio KEY: right triangle | hypotenuse

32. ANS:
Let h represent Max's height, in metres.

$$\tan 48° = \frac{\text{height of Max}}{\text{distance from Max to dog}}$$

$$\tan 48° = \frac{h}{1.2}$$

$1.2(\tan 48°) = h$

$1.3327\ldots = h$

Max is about 1.3 m tall.

PTS: 1 DIF: 1-2 OBJ: Section 3.3 NAT: M4
TOP: Solving Right Triangles
KEY: tangent ratio | determine a distance using an angle of elevation | determine a distance using trigonometry

33. ANS:
Let x represent the angle, in degrees, that the cable makes with the ground.

$$\cos x = \frac{\text{distance from cable to base of tower}}{\text{length of cable}}$$

$$\cos x = \frac{45}{100}$$

$$x = \cos^{-1}(0.45)$$

$$x = 63.2563\ldots$$

The angle that the cable makes with the ground is approximately 63°.

PTS: 1 DIF: 1-2 OBJ: Section 3.3 NAT: M4
TOP: Solving Right Triangles KEY: cosine ratio | determine an angle measure

34. ANS:
$\sqrt{9604} = 98$

PTS: 1 DIF: 1-2 OBJ: Section 4.1 NAT: AN1
TOP: Square Roots and Cube Roots KEY: prime factorization

35. ANS:
a) 100 km^2
b) 400 mm^2

PTS: 1 DIF: 1-2 OBJ: Section 4.1 NAT: AN1
TOP: Square Roots and Cube Roots KEY: area | perfect square

36. ANS:
a) $6\sqrt{7}$
b) $2\sqrt[3]{5}$
c) $9\sqrt{7}$

PTS: 1 DIF: 1-2 OBJ: Section 4.4 NAT: AN2
TOP: Irrational Numbers KEY: convert entire radical

37. ANS:
40.1

$$252\,ft\,\frac{1\ rotation}{2\pi\,ft} = 40.1\ rotations$$

PTS: 1 DIF: 3-4 OBJ: Section 1.2 NAT: M1
TOP: Imperial Measurement KEY: conversion | foot | imperial | yard | circumference | pi

38. ANS:
3.7 h

$$\frac{851\ km}{143\ mph}\frac{1\ mph}{1.61\ kmh} = 3.7\ hrs$$

PTS: 1 DIF: 3-4 OBJ: Section 1.3 NAT: M1 | M2
TOP: Converting Between SI and Imperial Systems
KEY: conversion | imperial | kilometre | mile | SI | speed

39. ANS:
138600 L

$$volume = \pi\left(\frac{9.9\ m}{2}\right)^2 1.8\ m = 138.6\ m^3$$

$$litres = 138.6\ m^3\ \frac{1000\ L}{1\ m^3} = 138600\ L$$

PTS: 1 DIF: 3-4 OBJ: Section 2.1 | Section 2.3
NAT: M1 | M3 | AN3 TOP: Units of Area and Volume | Volume
KEY: calculate volume | problem solving | right cylinder | SI

40. ANS:
295 mm^2

$$slant = \sqrt{(4.5\ mm)^2 + (11\ mm)^2} = 11.885\ mm$$

$$SA = area_{base} + 4 * area_{triangle} = 9\ mm * 9\ mm + 2 * 11.885\ mm * 9\ mm = 295\ mm^2$$

PTS: 1 DIF: 3-4 OBJ: Section 2.2 NAT: M3
TOP: Surface Area
KEY: calculate surface area | right pyramid | SI | slant height | square root

41. ANS:
5 mm

$$SA = 946\ mm^2 = 2(22\ mm * 11\ mm + 22 * h + 11 * h)$$

$$473\ mm^2 = 22\ mm * 11\ mm + 22 * h + 11 * h$$

$$231\ mm^2 = (22\ mm + 11\ mm) * h$$

$$h = 7\ mm$$

PTS: 1 DIF: 3-4 OBJ: Section 2.2 NAT: M3
TOP: Surface Area
KEY: determine height from surface area, length, and width | right prism | SI

42. ANS:
73 in.^{3}

$height = 1.2\,ft\dfrac{12\,in}{1\,ft} = 14.4\,in$

$area_{base} = \pi(2.2\,in)^2 = 15.21\,in^2$

$volume = \dfrac{15.21\,in^2 * 14.4\,in}{3} = 73\,in^3$

PTS: 1 DIF: 3-4 OBJ: Section 2.1 | Section 2.3
NAT: M1 | M3 | AN3 TOP: Units of Area and Volume | Volume
KEY: calculate volume | convert within the imperial system | right cone

43. ANS:
3.6 mm

$area_{base} = \pi(2.7\,mm)^2 = 22.9\,mm^2$

$volume = 27.5\,mm^3 = \dfrac{22.9\,mm^2 * h}{3}$

$h = \dfrac{3 * 27.5\,mm^3}{22.9\,mm^2} = 3.6\,mm$

PTS: 1 DIF: 3-4 OBJ: Section 2.3 NAT: M3 | AN3
TOP: Volume KEY: determine height from volume and radius | right cone | SI

44. ANS:
0.2 m

PTS: 1 DIF: 3-4 OBJ: Section 3.3 NAT: M4
TOP: Solving Right Triangles KEY: tangent ratio | determine a distance using trigonometry

45. ANS:
4.3 m

PTS: 1 DIF: 3-4 OBJ: Section 3.3 NAT: M4
TOP: Solving Right Triangles KEY: tangent ratio | determine a distance using trigonometry

46. ANS:
82°

PTS: 1 DIF: 3-4 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios KEY: cosine ratio | determine an angle measure

47. ANS:
40°

PTS: 1 DIF: 3-4 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios KEY: cosine ratio | determine an angle measure

48. ANS:
8 cm

PTS: 1 DIF: 3-4 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios
KEY: cosine ratio | determine a distance using trigonometry | right triangle

49. ANS:
37°

PTS: 1 DIF: 3-4 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios KEY: cosine ratio | determine an angle measure

50. ANS:
$6n$
$\sqrt[3]{216n^3} = 6n$

PTS: 1 DIF: 3-4 OBJ: Section 4.1 NAT: AN1
TOP: Square Roots and Cube Roots KEY: cube root

51. ANS:
$\frac{16}{729}$
$\left(\frac{2}{9}\right)^4 (9)$
$=\frac{16}{6561} * 9$
$=\frac{16}{729}$

PTS: 1 DIF: 3-4 OBJ: Section 4.2 NAT: AN3
TOP: Integral Exponents KEY: integral exponent | order of operations

52. ANS:
$225g^2$
$\left(15g\right)^2 = 15^2 g^2 = 225g^2$

PTS: 1 DIF: 3-4 OBJ: Section 4.1 NAT: AN1
TOP: Square Roots and Cube Roots KEY: perfect square | square root | area

53. ANS:
$160^{\frac{5}{4}}$

PTS: 1 DIF: 3-4 OBJ: Section 4.4 NAT: AN3
TOP: Irrational Numbers KEY: convert radical to power

54. ANS:
$\sqrt{-25^3}$

PTS: 1 DIF: 3-4 OBJ: Section 4.4 NAT: AN2
TOP: Irrational Numbers KEY: irrational number

55. ANS:
a rational exponent

PTS: 1 DIF: 3-4 OBJ: Section 4.3 NAT: AN3
TOP: Rational Exponents KEY: rational exponent

56. ANS:
3 days
$24 = 3 * 2^x$

$2^x = \frac{24}{3} = 8$

$x = 3$

PTS: 1 DIF: 3-4 OBJ: Section 4.2 NAT: AN3
TOP: Integral Exponents KEY: apply powers | growth

57. ANS:
$7\sqrt{11}$

PTS: 1 DIF: 3-4 OBJ: Section 4.4 NAT: AN2
TOP: Irrational Numbers KEY: convert entire radical

58. ANS:
$2j^{\frac{11}{2}}$

PTS: 1 DIF: 3-4 OBJ: Section 4.4 NAT: AN2
TOP: Irrational Numbers KEY: convert radical to power

59. ANS:
$\sqrt[3]{84}, 2\sqrt{30}, 4\sqrt{8}, 3\sqrt{18}$

PTS: 1 DIF: 3-4 OBJ: Section 4.4 NAT: AN2
TOP: Irrational Numbers KEY: order irrational numbers

60. ANS:
$\frac{s_m}{h_m} = \frac{s_j}{h_j}$

$s_m = \frac{h_m \times s_j}{h_j}$

$= \frac{20 \times 12}{21}$

$= 11.43$

The shadow cast by Melvin's house is 11.4 m long.

PTS: 5 DIF: 3-4 OBJ: Section 1.1 NAT: M1
TOP: SI Measurement KEY: proportional reasoning | metre

61. ANS:

a) The return trip takes 50 h.

$d = v \times t$

$= 70 \times 50$

$= 3500$

The return trip totals 3500 mi.

b) $d = 3500 \text{ mi} \times \dfrac{1.61 \text{ km}}{1 \text{ mi}}$

$= 5635 \text{ km}$

The total distance is 5635 km.

PTS: 1 DIF: 3-4 OBJ: Section 1.3 NAT: M1 | M2
TOP: Converting Between SI and Imperial Systems
KEY: conversion | imperial to SI | miles to kilometres

62. ANS:

a) Determine the slant height.

$s^2 = \left(\frac{24}{2}\right)^2 + 30^2$

$s^2 = 144 + 900$

$s = \sqrt{1044}$

$s = 32.310...$

SA = area of square base + lateral area

$SA = lw + 4\left[\frac{1}{2}(l)(s)\right]$

$SA = (24)(24) + 4[0.5(24)(32.310...)]$

$SA = 576 + 1550.88...$

$SA = 2126.88...$

The surface area of the right pyramid is approximately 2126.9 cm^2.

b) $SA = B$ + lateral area

$SA = \pi r^2 + \pi rs$

$SA = \pi(11)^2 + \pi(11)(30)$

$SA = 121\pi + 330\pi$

$SA = 451\pi$

$SA = 1416.858...$

The surface area of the right cone is approximately 1416.9 ft^2.

c) $SA = 4\pi r^2$

$SA = 4\pi(6.5)^2$

$SA = 169\pi$

$SA = 530.929...$

The surface area of the sphere is approximately 530.9 m^2.

PTS: 1 DIF: 3-4 OBJ: Section 2.2 NAT: M3 | AN3
TOP: Surface Area
KEY: calculate surface area | imperial | right cone | right pyramid | SI | sphere

63. ANS:

Since the cube has edge length 20.5 cm, the diameter of the volleyball is also 20.5 cm.
The radius is 10.25 cm.
Use the formula for the volume of a sphere.

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi(10.25)^3$

$V = 4510.868...$

The volume of the volleyball is approximately 4511 cm^3.

PTS: 1 DIF: 3-4 OBJ: Section 2.3 NAT: M3 | AN3
TOP: Volume KEY: calculate volume | right prism | SI | sphere

64. ANS:
a) $5.1^2 \text{ m}^2 + 3.5^2 \text{ m}^2 = 38.26 \text{ m}^2$
b) $4.3^2 \text{ yd}^2 + 9.3^2 \text{ yd}^2 = 104.98 \text{ yd}^2$

PTS: 1 DIF: 3-4 OBJ: Section 4.1 | Section 4.2
NAT: AN1 | AN3 TOP: Square Roots and Cube Roots | Integral Exponents
KEY: area | perfect square | integral exponent

65. ANS:
a) $\left(\frac{3}{2}\right)^6 \doteq 11.3906$

b) $\left(\frac{1}{4}\right)^{10} \doteq 9.5367 \times 10^{-7}$

PTS: 1 DIF: 3-4 OBJ: Section 4.2 NAT: AN3
TOP: Integral Exponents
KEY: exponent laws | quotient of powers | power of a power | negative exponent

66. ANS:
Find the side length, s, of the square faces of the box.
$s = \sqrt[3]{216}$
$= 6$
Each face is 6 cm by 6 cm and has an area of 36 cm^2.
$(5)(36) = 180$
The surface area of the five faces of the box is 45 cm^2.

PTS: 1 DIF: 3-4 OBJ: Section 4.1 NAT: AN1
TOP: Square Roots and Cube Roots KEY: area | volume | cube root

67. ANS:
4^5

PTS: 1 DIF: 3-4 OBJ: Section 4.2 NAT: AN3
TOP: Integral Exponents KEY: integral exponent | power

68. ANS:
1 min 44 s
$\frac{114\,yd}{1\,m/s}\frac{1\,m}{1.0936\,yd} = 104 \text{ sec}$
$\text{min} = \text{floor}\left(104\,s\frac{1 \text{ min}}{60\,s}\right) = 1$
$\text{sec} = 104\,s - 1 \text{ min}\frac{60\,s}{1 \text{ min}} = 44\,s$

PTS: 1 DIF: 5-6 OBJ: Section 1.3 NAT: M1 | M2
TOP: Converting Between SI and Imperial Systems
KEY: conversion | imperial | metre | SI | speed | yard

69. ANS:
94 cm^3

$area_{base} = \pi(2.3\ cm)^2 = 16.6\ cm^2$

$volume_{cone} = \dfrac{16.6\ cm^2 * 12.3\ cm}{3} = 68.1\ cm^3$

$volume_{scoop} = \dfrac{4\pi(2.3\ cm)^3}{3 * 2} = 25.5\ cm^3$

$volume = 68.1\ cm^3 + 25.5\ cm^3 = 94\ cm^3$

PTS: 1 DIF: 5-6 OBJ: Section 2.3 NAT: M3 | AN3
TOP: Volume KEY: calculate volume | problem solving | right cone | SI | sphere

70. ANS:
1207 cm^3

$area_{base} = (8\ cm)^2 = 64\ cm^2$

$volume_{bottom} = 64\ cm^2 * 22\ cm = 1408\ cm^3$

$volume_{top} = \dfrac{64\ cm^2 * 5\ cm}{2} = 160\ cm^3$

$volume = 1408\ cm^3 + 160\ cm^3 = 1568\ cm^3$

$juice = \dfrac{1568\ cm^3 * 77\ \%}{100\ \%} = 1207\ cm^3$

PTS: 1 DIF: 5-6 OBJ: Section 2.3 NAT: M3
TOP: Volume KEY: problem solving | right prism | SI | volume

71. ANS:

$$\sin A = \frac{\text{length of side opposite } \angle A}{\text{length of hypotenuse}}$$

PTS: 1 DIF: 5-6 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios KEY: sine ratio | define the sine ratio

72. ANS:
x = 7.2 m and y = 10.8 m

PTS: 1 DIF: 5-6 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios
KEY: sine ratio | determine a distance using trigonometry | right triangle

73. ANS:
63 cm^2

PTS: 1 DIF: 5-6 OBJ: Section 3.3 NAT: M4
TOP: Solving Right Triangles KEY: tangent ratio | right triangle | area

74. ANS:
Area of front and back faces:
$A = 2 \times 19 \times 14$
$= 532$
The area of the front and back faces of the box totals 532 cm^2.
Area of two long edges:
$A = 2 \times 19 \times 1.5$
$= 57$
The area of the two long edges of the box totals 57 cm^2.
Area of two short edges:
$A = 2 \times 14 \times 1.5$
$= 42$
The area of the two short edges of the box totals 42 cm^2.
Area needed for overlapping = 66 cm^2
Total area of wrapping:
$A = 532 + 57 + 42 + 66$
$= 697$
The total amount of plastic wrapping needed is 697 cm^2.

PTS: 2 DIF: 5-6 OBJ: Section 1.1 NAT: M1
TOP: SI Measurement KEY: surface area | centimetre | SI

75. ANS:
Surface area of the four long sides:
$A = 4 \times 3 \times 8$
$= 96$
The combined surface area of the four long sides is 96 cm^2.
Surface area of the two ends if they were whole:
$A = 2 \times 3 \times 3$
$= 18$
The combined surface area of the two ends, if they were whole, would be 18 cm^2.
Surface area lost for the hole in each end:
$A = 2 \times 1 \times 2$
$= 4$
The surface area lost for the hole in each end is 4 cm^2.
Surface area inside the hole:
$A = (2 \times 1 \times 8) + (2 \times 2 \times 8)$
$= 48$
The surface area inside the hole is 48 cm^2.
Total surface area:
$A = 96 + 18 - 4 + 48$
$= 158$
The total surface area of the figure is 158 cm^2.

PTS: 4 DIF: 5-6 OBJ: Section 1.1 NAT: M1
TOP: SI Measurement KEY: surface area | centimetre | SI

76. ANS:

$\tan 24° = \dfrac{AD}{BD}$

$\tan 24° = \dfrac{3.5}{BD}$

$BD = \dfrac{3.5}{\tan 24°}$

$BD = 7.8611\ldots$

$BC = 2(BD)$

$BC = 2(7.8611)$

$BC = 15.7222\ldots$

$BC \approx 15.7 \text{ m}$

The roof is approximately 15.7 m wide.

PTS: 1 DIF: 5-6 OBJ: Section 3.1 NAT: M4
TOP: The Tangent Ratio
KEY: tangent ratio | determine a distance using trigonometry | isosceles triangle

77. ANS:

$\cos Z = \dfrac{\text{side adjacent to } \angle Z}{\text{hypotenuse}}$

$\cos Z = \dfrac{ZW}{XZ}$

$\cos Z = \dfrac{13}{16}$

$\cos Z = 0.8125$

$Z = \cos^{-1}(0.8125)$

$Z = 36$

$\sin Z = \dfrac{XW}{XZ}$

$\sin 36° = \dfrac{XW}{16}$

$16(\sin 36°) = XW$

$9.3 = XW$

XW measures approximately 9.3 cm.

PTS: 1 DIF: 5-6 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios KEY: determine an angle measure | isosceles triangle

78. ANS:
Let h represent the height of the pole, in metres.

$$\tan 80° = \frac{\text{height of pole}}{\text{distance from base of pole to cable}}$$

$$\tan 80° = \frac{h}{7}$$

$$7(\tan 80°) = h$$

$$39.6990\ldots = h$$

Let x represent the angle, in degrees, between the second cable and the ground.

$$\tan x = \frac{\text{height of the pole}}{\text{distance from base of pole to cable}}$$

$$\tan x = \frac{39.7}{3(7)}$$

$$x = \tan^{-1}\left(\frac{39.7}{21}\right)$$

$$x = 62.1226\ldots$$

The second cable makes an angle of approximately 62° with the ground.

PTS: 1 DIF: 5-6 OBJ: Section 3.3 NAT: M4
TOP: Solving Right Triangles KEY: tangent ratio | solve a right triangle

79. ANS:
The volume is 3072 mm^3.

$$3072 = (4x)^3 - (2x)(2x)(4x)$$

$$3072 = 64x^3 - 16x^3$$

$$3072 = 48x^3$$

$$64 = x^3$$

$$x = 4$$

The dimensions of the cube are 16 mm by 16 mm by 16 mm.
The dimensions of the hole are 8 mm by 8 mm by 16 mm.

PTS: 1 DIF: 5-6 OBJ: Section 4.1 NAT: AN1
TOP: Square Roots and Cube Roots KEY: volume | cube root

80. ANS:
Example:
• product of powers: $(p^4)(p^2) = p^6$
• quotient of powers: $\frac{p^{18}}{p^{12}} = p^6$
• power of a power: $(p^2)^3 = p^6$

PTS: 1 DIF: 5-6 OBJ: Section 4.2 NAT: AN3
TOP: Integral Exponents KEY: exponent laws

81. ANS:
$P = 400(1.1)^{m-1}$, where P represents Matthew's pay, in dollars, and m is the pay number.
$P = 400(1.1)^{m-1}$
$= 400(1.1)^5$
$= 400(1.61051)$
$\doteq 644.20$
Matthew's pay in month 6 would be \$644.20.

PTS: 1 DIF: 5-6 OBJ: Section 4.3 NAT: AN3
TOP: Rational Exponents KEY: apply powers

82. ANS:
121.2 cm^2

$$height_{base} = \sqrt{(6\ cm)^2 + \left(\frac{6\ cm}{2}\right)^2} = 5.2\ cm$$

$$area_{base} = \frac{1}{2} 5.2\ cm * 6\ cm = 31.2\ cm^2$$

$$area_{lateral} = 3 * 5\ cm * 6\ cm = 90\ cm^2$$

$$SA = 121.2\ cm^2$$

PTS: 1 DIF: 7-8 OBJ: Section 2.2 NAT: M3 | AN3
TOP: Surface Area KEY: calculate surface area | problem solving | right prism | SI

83. ANS:
585.4 cm^2

$$slant_1 = \sqrt{\left(\frac{12\ cm}{2}\right)^2 + (16\ cm)^2} = 17.09\ cm$$

$$slant_2 = \sqrt{\left(\frac{13\ cm}{2}\right)^2 + (16\ cm)^2} = 17.27\ cm$$

$$area = 12\ cm * 13\ cm + 12\ cm * 17.27\ cm + 13\ cm * 17.09\ cm = 585.4\ cm^2$$

PTS: 1 DIF: 7-8 OBJ: Section 2.2 NAT: M3 | AN3
TOP: Surface Area
KEY: calculate surface area | right pyramid | SI | slant height | square root

84. ANS:
6 h

$$M = M_0\left(\frac{1}{8}\right)^{\frac{t}{18}} = M_0\left[\left(\frac{1}{2}\right)^3\right]^{\frac{t}{18}} = M_0\left(\frac{1}{2}\right)^{\frac{3t}{18}} = M_0\left(\frac{1}{2}\right)^{\frac{t}{6}}$$

PTS: 1 DIF: 7-8 OBJ: Section 4.3 NAT: AN3
TOP: Rational Exponents KEY: apply powers | decay

85. ANS:
Surface area of a right cylinder = $2\pi r^2 + 2\pi rh$
Area of each cut-out circle = πr^2
Surface area to be painted = surface area of cylinder – area of three circles
$SA = 2\pi r^2 + 2\pi rh - 3(\pi r^2)$
$SA = 2\pi r^2 + 2\pi rh - 3\pi r^2$
$SA = 2\pi rh - \pi r^2$

PTS: 1 DIF: 7-8 OBJ: Section 2.2 NAT: M3
TOP: Surface Area KEY: lateral area | right cylinder | surface area | write equation

86. ANS:

Volume of original cone $= \frac{1}{3}\pi r^2 h$

a) Double the radius:

$V = \frac{1}{3}\pi(2r)^2 h$

$V = \frac{1}{3}\pi(4r^2)h$

$V = \frac{4}{3}\pi r^2 h$

$V = 4\left(\frac{1}{3}\pi r^2 h\right)$

When the radius is doubled, the volume of the new cone is 4 times the volume of the original cone.

b) Double the radius and the height:

$V = \frac{1}{3}\pi(2r)^2 (2h)$

$V = \frac{1}{3}\pi(4r^2)2h$

$V = \frac{8}{3}\pi r^2 h$

$V = 8\left(\frac{1}{3}\pi r^2 h\right)$

When both the radius and the height are doubled, the volume of the new cone is 8 times the volume of the original cone.

c) Double the radius and halve the height:

$V = \frac{1}{3}\pi(2r)^2\left(\frac{1}{2}h\right)$

$V = \frac{1}{3}\pi(2r^2 h)$

$V = \frac{2}{3}\pi r^2 h$

$V = 2\left(\frac{1}{3}\pi r^2 h\right)$

When the radius is doubled and the height is halved, the volume of the new cone is twice the volume of the original cone.

PTS: 1 DIF: 7-8 OBJ: Section 2.3 NAT: M3 | AN3
TOP: Volume KEY: problem solving | right cone | volume

87. ANS:

If the radius of Mercury is r kilometres, the radius of Neptune is $10r$ kilometres.

a) Use the formula for the surface area of a sphere to set up a ratio.

$$\frac{4\pi(10r)^2}{4\pi r^2} = \frac{4\pi\left(100r^2\right)}{4\pi r^2}$$

$$= \frac{100}{1}$$

The ratio of the surface area of Neptune to the surface area of Mercury is 100:1.

b) Use the formula for the volume of a sphere to set up a ratio.

$$\frac{\frac{4}{3}\pi(10r)^3}{\frac{4}{3}\pi r^3} = \frac{\frac{4}{3}\pi\left(1000r^3\right)}{\frac{4}{3}\pi r^3}$$

$$= \frac{1000}{1}$$

The ratio of the volume of Neptune to the volume of Mercury is 1000:1.

PTS: 1 DIF: 7-8 OBJ: Section 2.2 | Section 2.3
NAT: M3 | AN3 TOP: Surface Area | Volume
KEY: problem solving | SI | sphere | surface area | volume

88. ANS:

a) $1\text{ km} = 1000\text{ m}$

$$\text{percent grade} = \left(\frac{\text{vertical rise}}{\text{horizontal distance}}\right) \times 100$$

$$\text{percent grade} = \left(\frac{80}{1000}\right) \times 100$$

$$\text{percent grade} = 8$$

The percent grade of the road is 8%.

b) Let θ represent the angle of elevation, in degrees.

$$\tan\theta = \frac{\text{vertical rise}}{\text{horizontal distance}}$$

$$\tan\theta = \frac{80}{1000}$$

$$\theta = \tan^{-1}\left(\frac{80}{1000}\right)$$

$$\theta = 5$$

The angle of elevation of the road is approximately 5°.

PTS: 1 DIF: 7-8 OBJ: Section 3.3 NAT: M4
TOP: Solving Right Triangles KEY: tangent ratio | angle of elevation

89. ANS:
When the conveyor is at its lowest elevation, in $\triangle ABC$, AC = 9 m and $\angle A = 5°$.

$$\sin 5° = \frac{BC}{9}$$

$$9(\sin 5°) = BC$$

$$0.7844... = BC$$

The lowest point of the opening is approximately 0.8 m above the ground.
When the conveyor is at its highest angle of elevation, in $\triangle DEB$, DE = 9 m and $\angle D = 20°$.

$$\sin 20° = \frac{BE}{9}$$

$$9(\sin 20°) = BE$$

$$3.0782... = BE$$

The highest point of the opening is approximately 3.1 m above the ground.
Size of opening = highest point – lowest point
Size of opening = 3.1 – 0.8
Size of opening = 2.3 m
The size of the opening is approximately 2.3 m.

PTS: 1 DIF: 7-8 OBJ: Section 3.3 NAT: M4
TOP: Solving Right Triangles
KEY: sine ratio | angle of elevation | determine a distance using trigonometry | determine a distance using an angle of elevation

90. ANS:

a) Let x represent the distance between Abdul and Yuri, in metres.

$$\cos 47° = \frac{\text{distance between Abdul and Yuri}}{\text{length of kite string}}$$

$$\cos 47° = \frac{x}{30}$$

$$30(\cos 47°) = x$$

$$20.5 = x$$

Abdul and Yuri are approximately 20.5 m apart.

b) Let h represent the height of the kite above the ground, in metres.

$$\sin 47° = \frac{\text{height of the kite above the ground}}{\text{length of kite string}}$$

$$\sin 47° = \frac{h}{30}$$

$$30(\sin 47°) = h$$

$$21.94 = h$$

Let x represent the horizontal distance between Abdul and the kite, in metres.

$$\tan 22° = \frac{\text{height of the kite above the ground}}{\text{horizontal distance between Abdul and the kite}}$$

$$\tan 22° = \frac{21.94}{x}$$

$$x = \frac{21.94}{\tan 22°}$$

$$x = 54.3$$

Distance between Abdul and Yuri = 20.5 + 54.3

= 74.8

The distance between Abdul and Yuri is now approximately 74.8 m.

PTS: 1 DIF: 7-8 OBJ: Section 3.2 NAT: M4
TOP: The Sine and Cosine Ratios
KEY: cosine ratio | determine a distance using trigonometry | angle of elevation | solve a right triangle