# Solution Manual for Basic Technical Mathematics with Calculus SI Version Canadian 10th Edition by Washington ISBN 0132762838 9780132762830



## Chapter 2

# Geometry

## 2.1 Lines and Angles

**1.**

*ABE* 90 because it is a vertically opposite angle to *CBD* which is also a right angle.

**2.**

Angles *POR* and *QOR* are complementary angles, so sum to 90

*POR* + *QOR* 90

+ *QOR* 90

*QOR* 90 32

*QOR* 58

**3.**

4 pairs of adjacent angles:

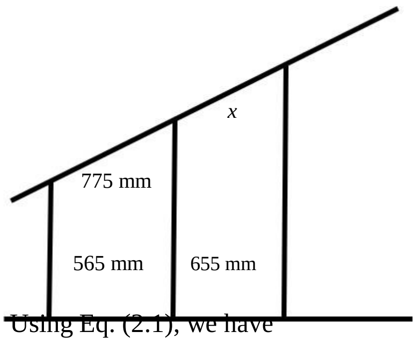
*BOC* and *COA* share common ray *OC*

*COA* and *AOD* share common ray *OA*

*AOD* and *DOB* share common ray *OD*

*DOB* and *BOC* share common ray *OB*

**4.**




Using Eq. (2.1), we have

$$\frac{x}{655}$$

$$x \quad \frac{775655}{565}$$

898 mm (the same answer as Example 5)

More vertical, since the distance along the beam is longer for the same horizontal run, which can only be achieved if the angle increases from horizontal (see sketch).

**15.**

**5.**
*EBD* and *DBC* are acute angles (i.e., < 90) .

**6.**
*ABE* and *CBE* are right angles (i.e., = 90) .

**7.**
*ABC* is a straight angle (i.e., = 180) .

**8.**
*ABD* is an obtuse angle (i.e., between 90 and 180) .

**9.**
The complement of *CBD* 65 is *DBE*

$CBD\ DBE\ \ 90$

$DBE\ 90$

$DBE\ 90\ 65$

$DBE\ 25$

**10.**
The supplement of *CBD* 65 is *ABD*

$CBD\ ABD\ 180$

$ABD\ 180\ \ ABD$

$180\ 65\ \ ABD$

$115$

**11.**
Sides *BD* and *BC* are adjacent to *DBC* .

**12.**
The angle adjacent to *DBC* is *DBE* since they share the common side BD, and *DBE* is acute because it is less than 90

**13.**

$AOB\ \ AOE\ EOB$

but *AOE* 90 because it is vertically opposite to *DOF* a given right angle, and*EOB* 50 because it is vertically opposite to *COF* a given angle of 50 , so *AOB* 90 50 140

**14.**

*AOC* is complementary to *COF* a given angle of 50 ,

$AOC\ COF\ \ 90$

$AOC\ 50\ \ \ 90$

$AOC\ \ 90\ 50$

$AOC\ \ 40$

**15.**

*BOD* is vertically opposite to *AOC* a found angle of 40 (see Question 14), so

*BOD AOC*

*BOD* 40

**16.**

1 is supplementary to 145 , so

1 180 145 35

2135

3 is supplementary to 2, so

31802

3 180 35

145

**17.**

is supplementary to 145 ,

so 1 180 145 35

2135

4 is vertically opposite to 2, so

4 2

35

**18.**

is supplementary to 145 ,

so 1 180 145 35

2135

5 is supplementary to 2, so

51802

180 35

145

**19.**

62 since they are vertically opposite

**20.**

1 62 since they are vertically opposite

2 is a corresponding angle to 5, so

2 5

since 1 and 5 are supplementary angles,

1 180

1 180

21801

2 180 62

2 118

**15.**

**21.**

90 62 since they are complementary angles

28

3 is an alternate-interior angle to 6, so

6

28

**22.**

3 28 (see Question 21)

since 4 and 3 are supplementary angles,

3 180

41803

4 180 28

4 152

**23.**

*EDF* *BAD* 44 because they are corresponding angles

*BDE* 90

*BDF* *BDE EDF*

*BDF* 90 44

*BDF* 134

**24.**

*CBE* *BAD* 44 because they are corresponding angles

*DBE* and *CBE* are complementary so

*DBE CBE* 90

*DBE* 90 *CBE*

*DBE* 90 44

*DBE* 46

and *ABE* *ABD DBE*

*ABE* 90 46

*ABE* 136

**25.**

*CBE* *BAD* 44 because they are corresponding angles

*DEB* and *CBE* are alternate interior angles, so

*DEB* *CBE*

*DEB* 44

**26.**

*CBE BAD* 44 because they are corresponding angles

*DBE* and *CBE* are complementary so

*DBE CBE* 90

*DBE* 90 *CBE*

*DBE* 90 44

*DBE* 46

**27.**

*EDF BAD* 44 because they are corresponding angles

Angles *ADB*, *BDE*, and *EDF* make a straight angle

*ADB BDE EDF* 180

*ADB* 180 *BDE EDF*

*ADB* 180 90 44

*ADB* 46

*DFE ADB* because they are corresponding angles

*DFE* 46

**28.**

*ADE ADB BDE*

*ADB* 46 (see Question 27)

*BDE* 90

*ADE* 46 90

*ADE* 136

Using Eq. (2.1), $\frac{a}{4.75}$ $\frac{3.05}{3.20}$

4.75 $\frac{3.05}{3.20}$

4.53 m

Using Eq. (2.1), $\frac{b}{6.25}$ $\frac{3.05}{3.20}$

6.25 $\frac{3.05}{3.20}$

5.96 m

Using Eq. (2.1), $\frac{c}{3.20}$ $\frac{5.05}{4.75}$

$\frac{(3.20)(5.05)}{4.75}$

3.40 m

Using Eq. (2.1), $\frac{d}{6.25} = \frac{5.05}{4.75}$

$d = \frac{(6.25)(5.05)}{4.75}$

$d = 6.64$ m

**33.**

$\angle BCE = 47°$ since those angles are alternate interior angles.

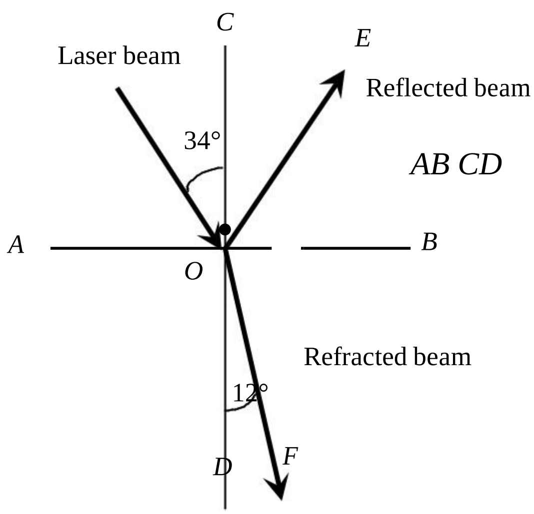
$\angle BCD$ and $\angle BCE$ are supplementary angles

$\angle BCD + \angle BCE = 180°$

$\angle BCD = 180° - 47°$

$\angle BCD = 133°$

**34.**




$\angle COE = 34°$

$\angle COD$ is a straight angle, so the total angle between the reflected and refracted beams, $\angle EOF$ is

$\angle COE + \angle EOF - \angle DOF = 180°$

$34° + \angle EOF - 12° = 180°$

$\angle EOF = 180° - 46°$

$\angle EOF = 134°$

This angle is a reflex angle.

Using Eq.
(2.1), $\frac{x}{519} = \frac{555}{519}$
$\frac{(825)(555)}{519}$
882 m

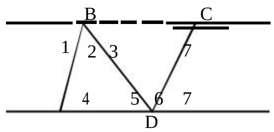
Using Eq. (2.1),
$\frac{AB}{3} = \frac{BC}{2}$
$AB = \frac{3(2.15)}{2}$
$AB$ 3.225 cm
$AC = AB + BC$
$AC$ 3.225 cm + 2.15 cm
$AC$ 5.375 cm
$AC$ 5.38 cm

**37.**
1 2 3 180 , because 1, 2, and 3 form a straight angle.

**38.**
4 since they are alternate interior angles
3 5 since they are alternate interior angles
2 3 180 , because 1, 2, and 3 form a straight angle, so
425180

**39.**
The sum of the angles with vertices at *A*, *B*, and *D* is 180.
Since those angles are unknown quantities, the sum of interior angles in a closed triangle is 180.

**40.**




2 3 180  since those angles form a straight angle

4 since they are alternate interior angles

423180

5 6 7 180 since those angles form a straight angle 7

alternate interior angle is shown

For the interior angles of the closed geometric figure ABCD,

sum 4 2 3 7 5 6

sum  4 2 3 5  6 7 sum = 180 180

sum = 360

## 2.2 Triangles

**1.**

5 45

3 45 since 3 and 5 are alternate interior angles.

1, 2, and 3 make a stright angle, so

123 180

70 2 45 180

2 65

**2.**

$\frac{1}{2} bh$

$\frac{1}{2}$ 61.2 5.75

176 $\text{cm}^2$

**3.**

$AC^2$ $AB^2$ $BC^2$

$AC^2$ $6.25^2$ $3.20^2$

$AC$ $\sqrt{6.25^2 \;\; 3.20^2}$

$AC$ 7.02 m

Using Eq.

(2.1), $h$ $\frac{24.0}{4.00}$

3.00

$\frac{(3.00)(24.0)}{4.00}$

18.0 m

**5.**

*ABC*180

*A* 40 84 180

56

**6.**

*ABC*180

*A* 48 90 180

42

**7.**

This is an isosceles triangle, so the base angles are equal.

$C$ 66

$ABC$ 180

48

**8.**

This is an isosceles triangle, so the base angles are equal.

$B$

$ABC$180

$A$ 110 180

2$A$ 70

35

**9.**

$\frac{1}{2}bh$

$\frac{1}{2}$ 7.6 2.2

8.4 m$^2$

**10.**

$bh$

2

$\frac{1}{2}$ 16.0 7.62

61.0 mm$^2$

By Hero's formula,

$p$ 205 322 415 942 cm

$\frac{942}{2}$ 471 cm

$A$ $\sqrt{s\ s\ a\ s\ b\ s\ c}$

$\sqrt{471 \text{ cm } 471\ 205 \text{ cm } 471\ 322 \text{ cm } 471\ 415 \text{ cm}}$

$\sqrt{471\ 266\ 149\ 56 \text{ cm}^4}$

32 300 cm$^2$

By Hero's formula,

86.2 23.5 68.4 178.1 m

178.1

$s$ 89.05 m

$A$ $s\sqrt{s\ a\ s\ b\ s\ c}$

[redacted] 89.05 86.2 89.05 23.5 89.05 68.4

586 $m^2$

**13.**

One leg can represent the base, the other leg the height.

$\frac{1}{2}bh$

$\frac{1}{2}$ 3.46 2.55

4.41 $cm^2$

**14.**

One leg can represent the base, the other leg the height.

$\frac{1}{2}bh$

$\frac{1}{2}$ 234 343

40 100 $mm^2$

By Hero's formula,

$p$ 0.986 0.986 0.884 m 1.428 m

2 2 *Assasbsc*

1.4281.428 0.986 1.428 0.986 1.428

0.884 $A$ 0.390 $m^2$

**16.** By Hero's formula,

3322 / 2 483 dm

$A$ [redacted] $s\ a$ [redacted] $^3$

483 483 $322^3$

44 900 $dm^2$

We add the lengths of the sides to get $p$ 205 322 415

942 cm

We add the lengths of the sides to get $p$ 23.5 86.2 68.4
178.1 m

We add the lengths of the sides to get $p$ 3(21.5) 64.5 cm

We add the lengths of the sides to get $p$ 2 2.45 3.22 8.12 mm

**21.**

$c^2 \quad a^2 \quad b^2$

$c \quad \sqrt{a^2 \quad b^2}$

[redacted] $^2$ [redacted] $22.7^2$

$c$ 26.6 mm

**22.**

$c^2 \quad a^2 \quad b^2$

$c \quad \sqrt{a^2 \quad b^2}$

$\sqrt{2.48^2 \; 1.45^2}$ $c$

2.87 m

**23.**

$c^2 \quad a^2 \quad b^2$

$b$ [redacted] $^2$ [redacted] $a^2$

$\sqrt{551^2 \quad 175^2}$

$b$ 522 cm

**24.**

$c^2 \quad a^2 \quad b^2$

$a$ [redacted] $^2$ [redacted] $b^2$

$\sqrt{0.836^2 \quad 0.474^2}$

0.689 km

**25.**

All interior angles in a triangle add to 180

23 $B$ 90 180

$B$ 180 90 23

67

**26.**

$c^2 \quad a^2 \quad b^2$

$c \quad \sqrt{a^2 \quad b^2}$

$\quad \sqrt{38.4^2 \; 90.5^2}$

$c$ 98.3 cm

**27.**

Length $c$ is found in Question 26, $c$ 98.309 77 cm

98.309 77 90.5 38.4 227.2 cm

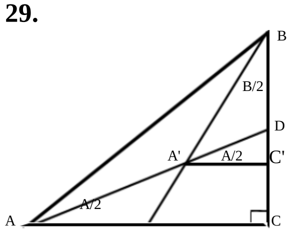
**28.**

$\frac{1}{2} bh$

$\frac{1}{2}$ 90.5 38.4

1740 cm$^2$

**29.**




$ADC \sim A'DC'$

$DA'C' \; A/2$

$BA'D$ between bisectors

From $BA'C'$, and all angles in a triangle must sum to 180

$\frac{B}{2} \; BA'D \; A/2 \; 90 \; 180$

$BA'D \; 90 \quad \frac{A}{2} \; \frac{B}{2}$

$BA'D \; 90 \quad \frac{A \; B}{2}$

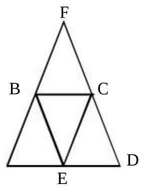
But $ABC$ is a right triangle, and all angles in a triangle must sum to 180

, so $A \; B \; 90$

$BA'D \; 90 \quad \frac{90}{2}$

$BA'D \; 45$

**30.**




*D* since *AFD* is isosceles.

Since *AF* *FD* *AFD* is isosceles and since *B* and *C* are midpoints,

*AB* *CD*

*AE* *DE* because *E* is a midpoint of *AD*,

so if two of the three sides are identical, the last side is the same too.

so *ABE* = *ECD*

Therefore, *BE* *EC* from which it follows that the inner *BCE* is isosceles.

Also, since *AB* *CD* *FB* *FC*

*ABE* = *ECD* *BFC* = *BCE*

and all four triangles are similar triangles to the original

*AFD* So, *BCE* is also 1/4 of the area of the original *AFD*.

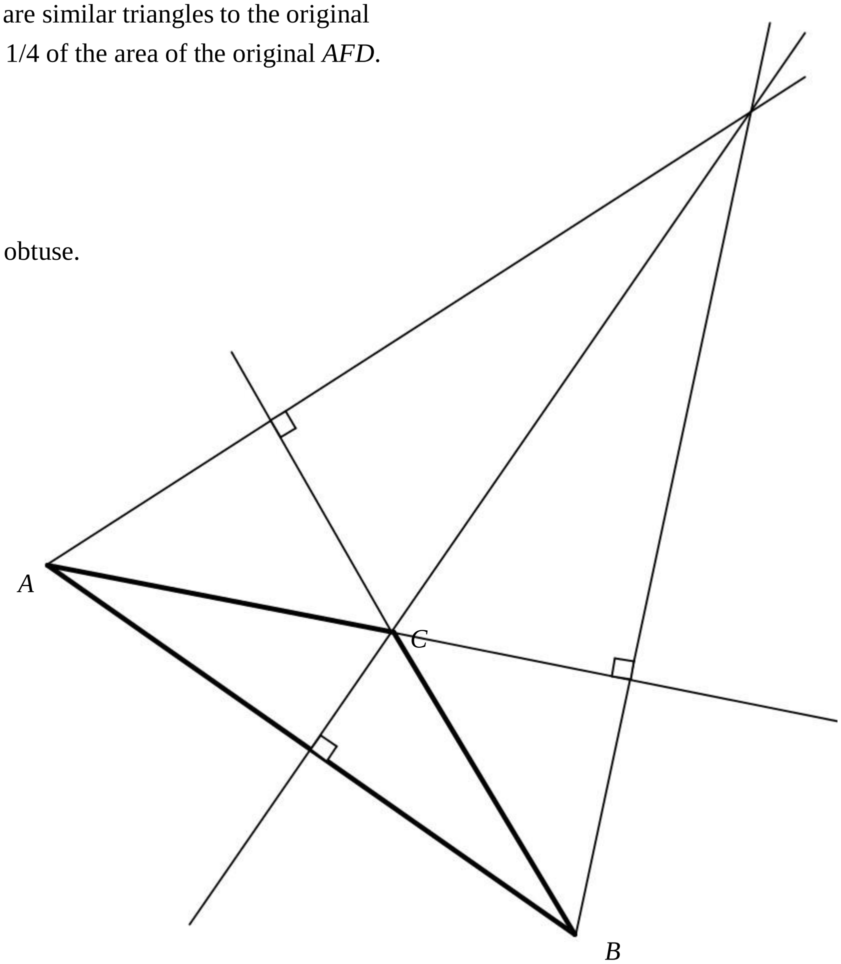
**31.**

An equilateral triangle.

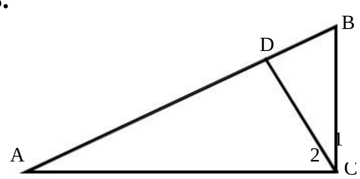
**32.**

Yes, if one of the angles of the triangle is obtuse.

For example, see *ABC* below.



**33.**

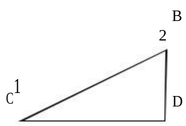



*B* 90

*B* 90 *A*

1

redraw *BDC* as

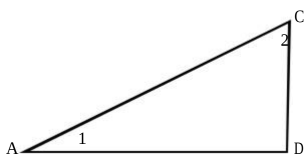



12 90

1*B* 90

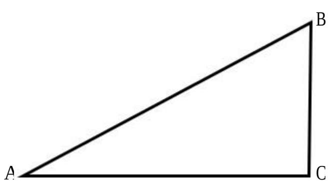
*B*

and *ADC* as




*BDC* and *ADC* are similar.

**34.**




Comparing the original triangle to the two smaller triangles (see Question 33) shows that all three are similar.

**35.**

*LMK* and *OMN* are vertically opposite angles and thus equal.
Since each triangle has a right angle, the remaining angle in each triangle must be the same.

*KLM* *MON*.

The triangles *MKL* and *MNO* have all the same angles, so therefore the triangles are similar:

*MKL* ~ *MNO*

**36.**

$ACB \quad ADC \quad 90$

$DAC \quad BAC$ since they share the common vertex $A$.

Since all angles in any triangle sum to 180 ,

$DCA$ 180 90 $BAC$,

$ABC$ 180 90 $BAC$,

Therefore, all the angles in $ACB$ and $ADC$ are equivalent, so

$ACB \sim ADC$

**37.**

$KM \quad KN \quad MN$

$KM \quad 159$

$KM \quad 6$

Since $MKL \sim MNO$

$$\frac{LM}{KM} \quad \frac{OM}{MN}$$

$$\frac{LM}{6} \quad \frac{12}{9}$$

$$LM \quad \frac{(6)(12)}{9}$$

$LM \quad 8$

**38.**

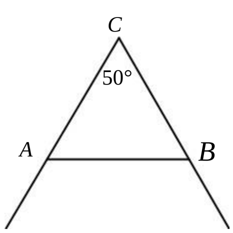
Since $ADC \sim ACB$

$$\frac{AB}{AC} \quad \frac{AC}{AD}$$

$$\frac{AB}{12} \quad \frac{12}{9}$$

$$AB \quad \frac{(12)(12)}{9}$$

$AB$ 16




$ABC$ is isosceles,

so $CAB \quad CBA$

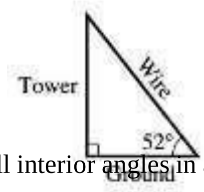
But all interior angles in a triangle sum to 180

$CAB$ $CBA$ 50 180

2$CAB$ 130

$CAB$ 65

**40.**




But all interior angles in a triangle sum to 180

angle between tower and wire 180 90 52 38

**41.**

$\frac{p}{2}$ $\frac{2\ 76.6\ 30.6}{2}$ 91.9 cm

By Hero's formula,

$A \quad s\sqrt{s\ a\ s\ b\ s\ c}$

[redacted] 91.9 76.6 91.9 76.6 91.6 30.6

1150 cm$^2$

**42.**

$\frac{p}{2}$ $\frac{3\ 1600}{2}$ 2400 km

By Hero's formula,

$A \quad s\sqrt{s\ a\ s\ b\ s\ c}$

$\sqrt{2400\ 2400\ 1600^3}$

1,100, 000 km$^2$

**43.**

One leg can represent the base, the other leg the height.

$A \quad \frac{1}{2}bh$

$\frac{1}{2}$ 3.2 6.0

9.6 m$^2$

**44.**

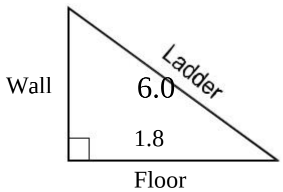
$c^2 \quad a^2 \quad b^2$

$c \quad \sqrt{a^2 \quad b^2}$

$\sqrt{750^2\ 550^2}$

$c$ 930 m

**45.**



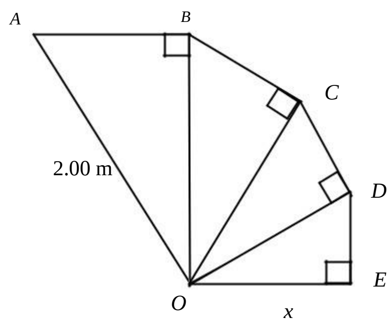

$c^2 \quad a^2 \quad b^2$

$b$ [redacted] $a^2}$

$\sqrt{6.0^2 \; 1.8^2}$

$b$ 5.7 m

**46.**




On $ABO$

the idea that the side opposite the 30 angle is half the hypotenuse gives

$AB$ 1.00 m

Using Pythagorean theorem gives

$AO^2 \quad AB^2 \quad BO^2$

$BO \quad \sqrt{AO^2 \quad AB^2}$

$BO \quad \sqrt{2^2 \quad 1^2}$

$BO \quad \sqrt{3}$ m

Using an identical technique on each successive triangle moving clockwise,

$BC$ [redacted] / 2 m

$CO \quad \sqrt{3 \quad \frac{3}{4}}$

$CO$ 1.50 m

$CD$ 0.750 m

$DO \quad \sqrt{1.50^2 \quad (0.750)^2}$

$DO$ 1.30 m

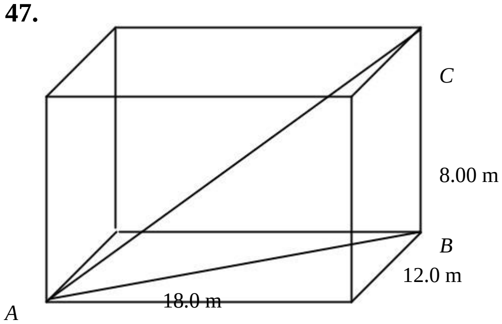
$DE$ 0.650 m

$\sqrt{1.30^2 \quad (0.650)^2}$

1.125 m

1.12 m

**47.**




Diagonal AB

$AB \quad \sqrt{18^2 \;\; 12^2} \quad \sqrt{468}$ m

Diagonal AC

$AC \quad \sqrt{AB^2 \;\; 8^2}$

$AC \quad \sqrt{468 \;\; 64}$ m

$AC \quad \sqrt{532}$ m

$AC$ 23.1 m

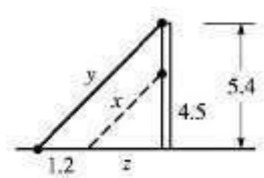
**48.** By Eq. (2.1),

$\dfrac{45.6 \text{ cm} \;\; 1.20 \text{ cm}}{x \qquad 1.00 \text{ m}}$

$x \;\; \dfrac{45.6 \text{ cm } (1.00 \text{ m})}{1.20 \text{ cm}}$

38.0 m

**49.**




By Eq. 2.1 ,

$\dfrac{\quad 1.2}{4.5 \quad 0.9}$

$z \;\; \dfrac{(4.5)(1.2)}{0.9}$

$z$ 6.0 m

$x^2 \;\; z^2 \;\; 4.5^2$

[redacted] m

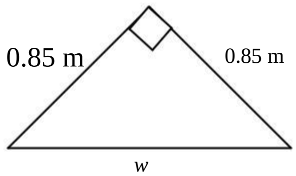
7.5 m

$y^2 \;\; 1.2 \; 6^2 \;\; 5.4^2$

[redacted] m

9.0 m

**50.**

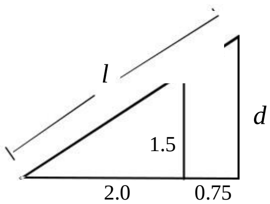



$w^2 \; 0.85^2 \; 0.85^2$

[redacted] m

$w$ 1.2 m

**51.**




By Eq. (2.1),

$\frac{\quad}{2.75} \; \frac{1.5}{2.0}$

$d \; \frac{2.75 \; 1.5}{2.0}$

2.0625 m

$l^2 \; 2.75^2 \; d^2$

$\sqrt{2.75^2 \; 2.0625^2}$

$l$ 3.4 m

**52.**

$\frac{ED}{AB} \; \frac{DC}{BC}$

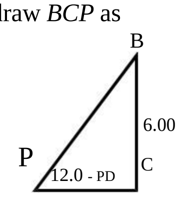
$\frac{ED}{80.0} \; \frac{312}{50.0}$

$ED \; \frac{(80.0)(312)}{50.0}$

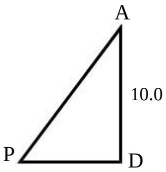
$ED$ 499 m

**53.**

Redraw *BCP* as



*APD* is




since *BCP* □ *ADP*

$\frac{6.00}{12.0\ PD} \quad \frac{10.0}{PD}$

$6PD\ 120\ 10PD$

$16PD\ 120$

$PD\ 7.50$ km

$PC\ 12.0\ PD$

$PC\ \ 4.50$ km

$l\ \ PB\ PA$

$l \quad \sqrt{4.50^2\ \ 6.00^2} \quad \sqrt{7.50^2\ \ 10.0^2}$

$7.50\ 12.5$

$l\ 20.0$ km

**54.**

Original area:

$$A_o = \frac{1}{2} bh$$

$$A_o = \frac{1}{2} x(\ x\ 12)$$

New area:

$$A_n = \frac{1}{2} bh$$

$$A_n = \frac{1}{2} x(\ x\ 12\ 16)$$

$$A_n = \frac{1}{2} x(\ x\ 4)$$

If the new area is 160 $cm^2$ larger than the original,

$A_n \quad A_o \quad 160$

$x(\ x\ 4)\ \frac{1}{2} x(\ x\ 12)\ 160$

$\frac{1}{2} x^2 \quad 2\ x \quad \frac{1}{2} x^2 \quad 6\ x\ 160$

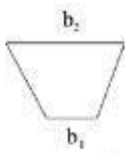
$8x\ 160$

20 cm is the orignal width $d\ x\ 12$

$d$ 8 cm is the original depth

## 2.3 Quadrilaterals

**1.**




trapezoid

**2.**

$4s$ $2w$ $2l$

4 540 2 540 2 920

$L$ 5080 mm

**3.**

$A_1$ $\frac{1}{2}bh$ $\frac{1}{2}$ 72 55 1980 2000 m$^2$

$A_2$ $bh$ 72 55 3960 4000 m$^2$

$A_3$ $\frac{1}{2}$ $h$ $b_1$ $b_2$ $\frac{1}{2}$ 55 72 35

$A_3$ 2942.5 2900 m$^2$

$A_{tot}$ 1980 3960 2942.5 8900 m$^2$

**4.**

2 $w$ 3.0 2$w$ 26.4

2$w$ 6.0 2$w$ 26.4

4$w$ 20.4

5.1 mm

$w$ 3.0 8.1 mm

**5.**

4$s$ 4 65 260 m

**6.**

4 2.46 9.84 km

**7.**

2 0.920 2 0.742 3.324 mm

**8.**

2 142 2 126 536 cm

**9.**

2$l$ 2$w$ 2 3.7 2 2.7 12.8 m

**10.**

$p$ 2 27.3 2 14.2 83.0 mm

**11.**
36.2 73.0 44.0 61.2 214.4 dm

**12.**
272 392 223 672 1559 cm

**13.**
$s^2$ $2.7^2$ 7.3 $mm^2$

**14.**
$15.6^2$ 243 $m^2$

**15.**
*lw* 0.920 0.742 0.683 $km^2$

**16.**
*lw* 142 126 17 900 $cm^2$

**17.**
*bh* 3.7 2.5 9.2 $m^2$

**18.**
*bh* 27.312.6 344 $mm^2$

**19.**
$A \frac{1}{2} h b_1 b_2$
$\frac{1}{2}$ 29.8 61.2 73.0
$2.00\ 10^3$ $dm^2$

**20.**
$_2$ *b*
201392 672
$_2$
107 000 $cm^2$

**21.**
2*b* 4*a*

**22.**
*a b b a b a b a p*
2*a* 2*b* 2*b* 2*a* *p* 4*b*

**23.**
$A\ bh\ a^2$

**24.**

$A \frac{1}{2} a\, b\, b\, a \frac{1}{2}\, a\, b\, b\, a$

$A\ \ ab \frac{1}{2} a^2\ \ ab\ \frac{1}{2} a^2$

$A\ \ 2ab\ a^2$

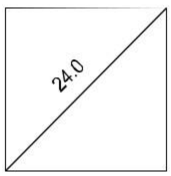
**25.**

The parallelogram is a rectangle.

**26.**

The triangles are congruent. Corresponding sides and angles are equal.

**27.**




$s^2\ \ s^2\ 24.0^2$

$2s^2\ \ 576$

$s^2\ \ \frac{576}{2}$

$A\ s^2\ \ 288\ \text{cm}^2$

**28.**

*A* *D*

*B*

*F* *C* *E*

*G*

*CAD* and *FCA* are alternate interior angles, and so

$CAD = FCA$

$CAB \ \frac{1}{2} CAD$ because of the angle bisector *AE*

$CAB \ \frac{1}{2} FCA$

*ACE* and *FCA* are supplementary angles, so

$ACE \ 180 \ FCA$

$ACB \ \frac{1}{2} ACE$ because of the angle bisector *CD*

$ACB \ 90 \ \frac{1}{2} FCA$

Analysing *ABC*, all interior angles should sum to 180

$CAB \ ABC \ ACB \ 180$

$\frac{1}{2} FCA \ ABC \ 90 \ \frac{1}{2} FCA \ 180$

$ABC \ 90$

**29.**

The diagonal always divides the rhombus into two congruent triangles. All outer sides are always equal.

**30.**

The hypotenuse of the right triangle is

$c^2 \ a^2 \ b^2$

[redacted] $^2$ [redacted] $12^2$

$\sqrt{400}$

$c \ 20$

In a rhombus, all four sides are equivalent, so

4 20 80 mm

**31.**

For the courtyard

$\frac{p}{4} \ \frac{324}{4} \ 81.0$ m

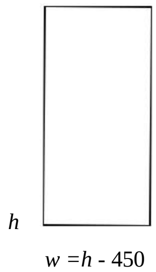
81.0 6.00 87.0 m

4*x*

487.0

*p* 348 m

**32.**




2$h$ 2 $h$ 450

4500 2$h$ 2$h$ 900

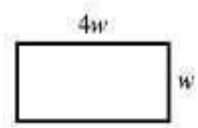
5400 4$h$

1350 mm

$w$ $h$ 450

$w$ 900 mm

**33.**




If width increases by 1500 mm and length decreases by 4500 mm the dimensions will be equal (a square).

$w$ 1500 4$w$ 4500

6000 3$w$

2000 mm

4$w$ 8000 mm

**34.**

$A$ $bh$

1.80(3.50)

$A$ 6.30 $m^2$

**35.**

The trapezoid has lower base 9300 mm and upper base 5300 mm, making the lower side 4000 mm longer than the upper side. This means that a right triangle in each corner can be built with hypotenuse *c* of 3300 mm and horizontal leg (base *b*) of 2000 mm

$c^2 \; b^2 \; h^2$

$h$ [redacted] $b^2$

[redacted] $2000^2$

[redacted] $890\,000$

$A_{paint}$ 2 area of trapezoid area of window

$A_{paint}$ $2\,\frac{1}{2}h(b \;\; b_1\;)\; lw_2$

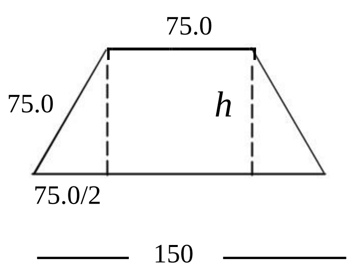
$A_{paint}$ $2\;\frac{1}{2}\sqrt{\;\;6\,890\,000}\;9300\;5300\;1200\;4200$

$A_{paint}$ $28\,243\,262\text{ mm}^2$

$V_{paint}$ $28\,243\,262\text{ mm}^2\;\frac{1\text{ m}}{1000\text{ mm}}^2\;\frac{1\text{ L}}{12\text{ m}^2}$

$V_{paint}$ 2.4 L of paint (to two significant digits)

**36.**




$75^2 \;\; 37.5^2 \;\; h^2$

$\sqrt{75.0^2 \; 37.5^2}$

$h$ 64.9519 cm

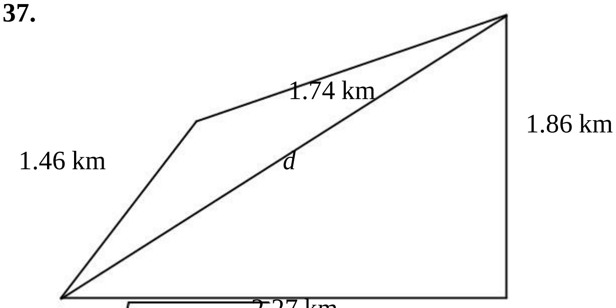
$A$ area of 6 identical trapezoids

$A\; 6\;\frac{1}{2}h(b\;\; b\;)_{12}$

3(64.9519 cm) 75.0 150

cm $A$ 43 800 $\text{cm}^2$

**37.**




$\sqrt{2.27^2 \quad 1.86^2} \quad d$

2.934706 km For the right triangle,

2

2

$2.1111 \text{ km}^2$

$\underline{1.46\ 1.74\ d}$
2

$\underline{1.46\ 1.74\ 2.934706}$
2

3.06735 km

$\sqrt{s\ s\ 1.46\ s\ d\ s\ 1.74}$

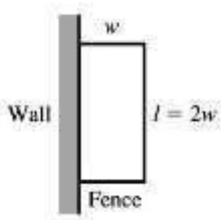
[redacted] 3.06735 1.46 3.06735 2.934706 3.06735 1.74

$0.931707 \text{ km}^2$

$2.1111 \text{ km}^2\ 0.931707 \text{ km}^2$

$A\ 3.04 \text{ km}^2$

**38.**




*Cost* cost of wall + cost of fence

13200 50 2*w* 5 2*w* 5*w* 5*w*

13200 120*w w*

110 m *l*

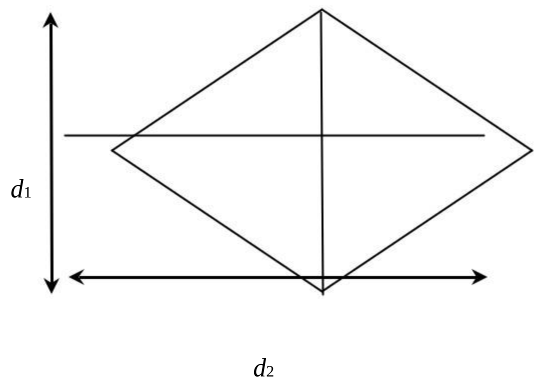
2*w*

220 m

**39.**

A diagonal divides a quadrilateral into two triangles, and the sum of the interior angles of each triangle is 180.

**40.**




The rhombus consists of four triangles, the areas of which are equal since the sides are all consistently $\frac{1}{2}d_1$ and $\frac{1}{2}d_2$

$$A = 4\left(\frac{1}{2}\right)\left(\frac{1}{2}d_2\right)\left(\frac{1}{2}d_1\right)$$

$$A = \frac{1}{2}d_1 d_2$$

## 2.4 Circles

**1.** $OAB$ $OBA$ $AOB$ 180

$OAB$ 90 72 180

$OAB$ 18

**2.** $A$ $r^2$ $2.4^2$

$A$ 18 $km^2$

**3.** $p$ $2s$ $\frac{2s}{4}$ $2s$ $\frac{s}{2}$

$p$ 2 3.25 $\frac{3.25}{2}$

11.6 in.

$A$ $\frac{s^2}{4}$ $\frac{3.25}{4}$

8.30 $in^2$

$AC$ 2 $ABC$

225

50

(a) $AD$ is a secant line.

$AF$ is a tangent line.

(a) $EC$ and $BC$ are chords.

$ECO$ is an inscribed angle.

(a) $AF$ $OE$.

$OCE$ is isosceles.

(a) $EC$ and $E$ $C$ enclose a segment.

Radii $OE$ and $OB$ enclose a sector

with an acute central angle.

$c$ 2 $r$ 2 275 1730 cm

$c$ 2 $r$ 2 0.563 3.54 m

$d$ $2r$; $c$ $d$ 23.1 72.6 mm

$c$ $d$ 8.2 26 dm

$A$ $r^2$ $0.0952^2$ 0.0285 $km^2$

$A\ r^2\quad 45.8^2\quad 6590\text{ cm}^2$

**15.** $A\quad d/2^2\quad 2.33/2^2\ 4.26\text{ m}^2$

$A\ \frac{1}{4}d^2\ \frac{1}{4}1256^2\quad 1\,239\,000\text{ mm}^2$

*CBT* 90 *ABC* 90 65 25

*BCT* 90 , any angle such as *BCA* inscribed in a semicircle is a right angle and *BCT* is supplementary to *BCA*.

A tangent to a circle is perpendicular to the radius drawn to the point of contact. Therefore,
*ABT* 90
*CBT ABT ABC* 90 65 25;
*CAB* 25
*BTC* 65 ; *CBT* 35 since it is complementary to *ABC* 65.
*CBT* 35 *BTC* 90 Therefore
*BTC* 65

**21.** $\overset{\frown}{BC} = 2(60) = 120^\circ$

**22.** $\overset{\frown}{BC} = 2(60^\circ) = 120$

$\overset{\frown}{AB} + 80^\circ + 120^\circ = 360^\circ$

$\overset{\frown}{AB} = 160$

**23.** *ABC* 1/ 2 80 40 since the measure of an inscribed angle is one-half its intercepted arc.

**24.** $ACB\ \frac{1}{2}\ 160\ 80$

**25.** $022.5\quad 022.5\frac{\text{rad}}{180}\quad 0.393\text{ rad}$

**26.** $60.0\ 60.0\ \frac{\text{rad}}{180}\ 1.05\text{ rad}$

**27.** $125.2\ 125.2\frac{\text{rad}}{180}\ 2.185\text{ rad}$

**28.** 323.0 323.0 $\frac{\text{rad}}{180}$ 5.64 rad

**29.** Perimeter $\frac{1}{4}$ 2 $r$ 2$r$ $\frac{r}{2}$ 2$r$

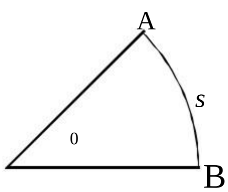
**30.** Perimeter $a$ $b$ $\frac{1}{4}$ 2 $r$ $r$

Area $\frac{1}{4}$ $r^2$ $\frac{1}{2}$ $r^2$

Area $\frac{1}{2}$ $ar$ $\frac{1}{4}$ $r^2$

All are on the same diameter.

**34.**

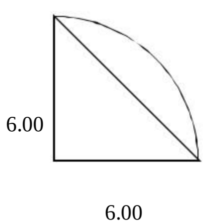



»$AB$ = 45°

$\frac{s}{2pr} = \frac{45^\circ}{360^\circ}$

$s = \frac{p}{4} \times r$

**35.**




$A$ of sector = $A$ of quarter circle $A$ of triangle

$\frac{1}{4}$ $6.00^2$ $\frac{1}{2}$ 6.00 6.00

10.3 $\text{cm}^2$

*ACB DCE* (vertical angles)

*BAC DEC* and

*ABC CDE* (alternate interior angles) The triangles are similar since corresponding angles are equal.

**37.** $C\ 2\ r\ 2\ 6375\ 40\ 060$ km

**38.** $11\ 2\ r\ 109$

$r$ 1.58 mm

**39.** $\dfrac{A_{basketball}}{A_{hoop}}\ \dfrac{\left(\frac{30.5}{2}\right)^2}{\left(\frac{45.7}{2}\right)^2}\ \dfrac{0.445}{1}$

**40.** flow rate $\dfrac{volume}{time}\ \dfrac{_1 r^2 L}{t}$

2 flow rate $\dfrac{_2 r^2}{t}\ \dfrac{2\ r_1^2}{t}$

$r_2^2\ 2\ r_1^2$

$r_2\ \sqrt{2} r_1$

**41.**

112

$c\ d\ d$

$c$ /

112 /

35.7 cm

**42.** $A\ \left(\dfrac{15.8}{2}\right)^2\ 196\ \text{cm}^2$

**43.** $A\ \ 90^2\ 45^2$

2

9500 cm$^2$

**44.**

Let $D$ diameter of large conduit, then

$3d$ , where $d$ diameter of smaller conduit

$F\ \dfrac{\text{area large conduit}}{\text{area 7 small conduits}}$

$\dfrac{7\ \frac{d^2}{4}}{\frac{D^2}{4}}$

$\dfrac{7d^2}{D^2}\ \ \dfrac{7d^2}{3d^2}\ \ \dfrac{7d^2}{9d^2}$

$\dfrac{7}{9}$

The smaller conduits occupy $\dfrac{7}{9}$ of the larger

*A* of room *A* of rectangle $\frac{3}{4}$ *A* of circle

$$8100\ 12\ 000\ \frac{3}{4}\ 320^2$$

$$9.7\ 10^7\ \text{mm}^2$$

Length 2 $\frac{3}{4}$ 2 5.5 4 5.5 73.8 cm

Horizontally and opposite to original direction

Let *A* be the left end point at which the dashed lines intersect and *C* be the center of the gear. Draw a line from *C* bisecting the 20 angle. Call the intersection of this line and the extension of the upper dashed line *B*, then

$$\frac{360}{24\text{ teeth}}\ \frac{15}{\text{tooth}}\ ACB\ 7.5$$

$$ABC\ 180\ \frac{20}{2}\ 170$$

$$x\ ABC\ ACB\ 180\ 2$$

$$x\ 170\ 7.5\ 180\ 2$$

$$\frac{x}{2}\ 2.5$$

5

*s* *r*

$$s\ (2.8)\ \frac{450}{2}\ \text{km}$$

*s* 630 km

## 2.5 Measurement of Irregular Areas

**1.**
The use of smaller intervals improves the approximation since the total omitted area or the total extra area is smaller. Also, since the number of intervals would be 10 (an even number) Simpson's Rule could be employed to achieve a more accurate estimate.

**2.**
Using data from the south end as stated gives only five intervals. Therefore, the trapezoidal rule must be used since Simpson's rule cannot be used for an odd number of intervals.

**3.**
Simpson's rule should be more accurate in that it accounts better for the arcs between points on the curve, and since the number of intervals (6) is even, Simpson's Rule can be used.

**4.**
The calculated area would be too high since each trapezoid would include more area than under the curve. The shape of the curve is such that a straight line approximation for the curve will always overestimate the area below the curve (the curve dips below the straight line approximation).

**5.**

$$A_{trap} \quad \frac{h}{2} \quad y_0 \quad 2y_1 \quad 2y_2 \quad \ldots 2 \quad y_{n\,1} \quad y_n$$

$$A_{trap} \quad \frac{2.0}{2} \quad 0.0\ 2\ 6.4\ 2\ 7.4\ 2\ 7.0\ \ 2\ 6.1\ 2\ 5.2\ 2\ 5.0\ 2\ 5.1\ 0.0$$

$A_{trap}$ 84.4 84 $\text{m}^2$ to two significant digits

**6.**

$$A_{simp} \quad \frac{h}{3} y_0 \quad 4y_1 \quad 2y_2 \quad 4y_3 \qquad 2y_{n\,2} \quad 4y_{n\,1} \quad y_n$$

$$A_{simp} \quad \frac{2}{3} \, 0\ 46.4\ 27.4\ 47.0\ 26.1\ 45.2\ 25.0\ 45.1\ 0$$

$A_{simp}$ 87.8667 $\text{m}^2$ 88 $\text{m}^2$ (to two significant digits)

**7.**

$$A_{simp} \quad \frac{h}{3} \, y_0 \quad 4y_1 \quad 2y_2 \quad 4y_3 \qquad 2y_{n\,2} \quad 4y_{n\,1} \quad y_n$$

$$A_{simp} \quad \frac{0.30}{3} \quad 0\ 4\ 0.16\ 20.23\ 4\ 0.32\ 2\ 0.35\ 4\ 0.30\ 0.20$$

$A_{simp}$ 0.448 $\text{m}^2$ 0.45 $\text{m}^2$ (rounded to 2 significant digits)

**8.**

$$A_{trap} \quad \frac{h}{2} y_0 \; 2y_1 \; 2y_2 \; \ldots \; 2y_{n1} \; y_n$$

$$A_{trap} \quad \frac{0.3}{2} \; 0 \; 2 \; 0.16 \; 2 \; 0.23 \; 2 \; 0.32 \; 2 \; 0.35 \; 2 \; 0.30 \; 0.20$$

$A_{trap}$ $0.438 \text{ m}^2$ $0.44 \text{ m}^2$ (rounded to 2 significant digits)

**9.**

$$A_{trap} \quad \frac{h}{2} y_0 \; 2y_1 \; 2y_2 \; \ldots \; 2y_{n1} \; y_n$$

$$A_{trap} \quad \frac{0.5}{2} 0.6 \; 2 \; 2.2 \; 2 \; 4.7 \; 23.1 \; 23.6 \; 21.6 \; 2 \; 2.2 \; 21.5 \; 0.8$$

$A_{trap}$ $9.8 \text{ km}^2$

**10.**

$$A_{simp} \quad \frac{h}{3} y_0 \; 4y_1 \; 2y_2 \; 4y_3 \; 2y_{n2} \; 4y_{n1} \; y_n$$

$$A_{simp} \quad \frac{0.5}{3} \; 0.6 \; 4 \; 2.2 \; 2 \; 4.7 \; 4 \; 3.1 \; 2 \; 3.6 \; 41.6 \; 2 \; 2.2 \; 41.5 \; 0.8$$

$A_{simp}$ $9.3333 \text{ km}^2$ $9.3 \text{ km}^2$ (rounded to 2 significant digits)

**11.**

$$A_{trap} \quad \frac{h}{2} y_0 \; 2y_1 \; 2y_2 \; \ldots \; 2y_{n1} \; y_n$$

$$A_{trap} \quad \frac{6.0}{2} \; 7 \; 215 \; 27 \; 211 \; 213 \; 210 \; 29 \; 212 \; 28 \; 3$$

$$A_{trap} \quad 540 \text{ mm}^2 \; \frac{6 \text{ km}^2}{1 \text{ mm}}$$

$A_{trap}$ $19\,000 \text{ km}^2$

**12.**

$$A_{simp} \quad \frac{h}{3} y_0 \; 4y_1 \; 2y_2 \; 4y_3 \; 2y_{n2} \; 4y_{n1} \; y_n$$

$$A_{simp} \quad \frac{1.5}{3} 0 \; 4 \; 5.0 \; 2 \; 7.2 \; 4 \; 8.3 \; 28.6 \; 4 \; 8.3 \; 2 \; 7.2 \; 4 \; 5.0 \; 0.0$$

$A_{simp}$ $76.2 \text{ m}^2$ $76 \text{ m}^2$

**13.**

$$A_{trap} \quad \frac{h}{2} y_0 \; 2y_1 \; 2y_2 \; \ldots \; 2y_{n1} \; y_n$$

$$A_{trap} \quad \frac{2.0}{2} 0 \; 2 \; 5.2 \; 2 \; 14.1 \; 2 \; 19.9 \; 2 \; 22.0 \; 2 \; 23.4 \; 2 \; 23.6 \; 2 \; 22.5$$

$$2 \; 17.9 \; 2 \; 16.5 \; 2 \; 13.5 \; 2 \; 9.1 \; 0$$

$A_{trap}$ $375.4 \text{ km}^2$ $380 \text{ km}^2$

**8.**

**14.**

$A_{simp} \frac{h}{3} y_0 \; 4y_1 \; 2y_2 \; 4y_3 \; 2y_{n2} \; 4y_{n1} \; y_n$

$A_{simp} \frac{2}{3} 0 \; 4\; 5.2 \; 2\; 14.1 \; 4 19.9 \; 2\; 22.0 \; 4\; 23.4 \; 2\; 23.6 \; 4\; 22.5$

$2 17.9 \; 4\; 16.5 \; 2\; 13.5 \; 4 9.1 \; 0$

$A_{simp} \; 379.07 \text{ km}^2 \; 380 \text{ km}^2$

**15.**

$A_{simp} \frac{h}{3} y_0 \; 4y_1 \; 2y_2 \; 4y_3 \; 2y_{n2} \; 4y_{n1} \; y_n$

$A_{simp} \frac{50}{3} \; 5 \; 4 12 \; 2 17 \; 4 21 \; 2 22 \; 4 25 \; 2 26 \; 4 16 \; 2 10 \; 4 8 \; 0$

$A_{simp} \; 8050 \text{ m}^2 \; 8.0 \; 10^3 \text{ m}^2$

**16.**

$A_{trap} \frac{h}{2} y_0 \; 2y_1 \; 2y_2 \; ... \; 2 \; y_{n1} \; y_n$

$A_{trap} \frac{2.0}{2} 3.5 \; 2\; 6.0 \; 2\; 7.6 \; 2\; 10.8 \; 2\; 16.2 \; 2\; 18.2 \; 2\; 19.0 \; 2\; 17.8 \; 2\; 12.5 \; 8.2$

$A_{trap} \; 228.7 \text{ cm}^2$

$A_{circles} \; 2 \; \frac{d^2}{4}$

$A_{circles} \; \frac{(2.50 \text{ cm})^2}{2} \; 9.817477 \text{ cm}^2$

$A_{total} \; 228.7 \text{ cm}^2 \; 9.817477 \text{ cm}^2$

$A_{total} \; 218.88 \text{ cm}^2 \; 220 \text{ cm}^2$

**17.**

$A_{trap} \frac{h}{2} y_0 \; 2y_1 \; 2y_2 \; ... \; 2 \; y_{n1} \; y_n$

$A_{trap} \frac{0.500}{2} 0.0 \; 2\; 1.732 \; 2\; 2.000 \; 2\; 1.732 \; 0.0$

$A_{trap} \; 2.73 \text{ cm}^2$

This value is less than $3.14 \text{ cm}^2$ because all of the trapezoids are inscribed.

**18.**

$A_{trap} \frac{h}{2} y_0 \; 2y_1 \; 2y_2 \; ... \; 2 \; y_{n1} \; y_n$

$A_{trap} \frac{0.250}{2} 0.000 \; 2\; 1.323 \; 2\; 1.732 \; 2\; 1.936 \; 2\; 2.000$

$2 \; 1.936 \; 2\; 1.732 \; 2\; 1.323 \; 0.000$

$A_{trap} \; 3.00 \text{ cm}^2$

The trapezoids are smaller so they can get closer to the boundary, and less area is missed from the calculation.

**19.**

$$A_{simp} = \frac{h}{3}\left(y_0 + 4y_1 + 2y_2 + 4y_3 + \cdots + 2y_{n-2} + 4y_{n-1} + y_n\right)$$

$$A_{simp} = \frac{0.500}{3}\left[0.000 + 4(1.732) + 2(2.000) + 4(1.732) + 0.000\right]$$

$$A_{simp} = 2.98 \text{ cm}^2$$

The ends of the areas are curved so they can get closer to the boundary, including more area in the calculation.

**20.**

$$A_{simp} = \frac{h}{3}\left(y_0 + 4y_1 + 2y_2 + 4y_3 + \cdots + 2y_{n-2} + 4y_{n-1} + y_n\right)$$

$$A_{simp} = \frac{0.250}{3}\left[0.000 + 4(1.323) + 2(1.732) + 4(1.936) + 2(2.000) + 4(1.936) + 2(1.732) + 4(1.323) + 0.000\right]$$

$$A_{simp} = 3.08 \text{ cm}^2$$

The areas are smaller so they can get closer to the boundary.

## 2.6 Solid Geometric Figures

**1.**

$V_1\ lwh$

$V_2\ 2l\ w\ 2h$

$V_2\ 4lwh$

$V_2\ 4V_1$

The volume increases by a factor of 4.

**2.**

$s^2\ r^2\ h^2$

$h$ [redacted] $^2$ [redacted] $r^2$

[redacted] $^2$ [redacted] $11.9^2$

12.8 cm

**3.**

$\frac{1}{3}\ r^2\ h$

$V\ \frac{1}{3}\ \frac{11.9\text{ cm}}{2}^2\ 2\ 10.4\text{ cm}$

$771\text{ cm}^3$

**4.**

$V\ r^2\ h\ \frac{1}{2}\ \frac{4}{3}\ r^3$

$V\ 12.0^2\ \frac{40}{2}\ \frac{2}{3}\ 12.0^3$

$V\ 12666.902\text{ m}^3$

$V\ 12700\text{ m}^3$

**5.**

$V\ s^3$

7.15 cm

$^3\ V\ 366\text{ cm}^3$

**6.**

$V\ r^2\ h$

$23.5\text{ cm}^2\ 48.4\text{ cm}$

$V\ 83971.3\text{ cm}^3$

$V\ 8.40\ 10^4\text{ cm}^3$

**7.**

$A\ \ 2\ r^{2}\ \ 2\ rh$

$2\ 689^{2}\ 2\ 689\ 233$

$A\ 3\ 991\ 444\ \text{m}^{2}$

$A\ \ 3.99\ 10^{6}\ \ \text{m}^{2}$

**8.**

$4\ r^{2}$

$4\ 0.067\ \text{mm}$

$^{2}\ A\ 0.056\ \text{mm}^{2}$

**9.**

$\frac{4}{3} r^{3}$

$\frac{4}{3} 0.877\ \text{m}^{3}$

$2.83\ \text{m}^{3}$

**10.**

$\frac{1}{3} r^{2} h$

$\frac{1}{3} 25.1\ \text{mm}^{2}\ 5.66\ \text{mm}$

$3730\ \text{mm}^{3}$

**11.**

$S\ \ rs$

$78.0\ \text{cm}\ 83.8\ \text{cm}$

$S\ 20\ 534.71\ \text{cm}^{2}$

$S\ \ 20\ 500\ \text{cm}^{2}$

**12.**

$S\ \ \frac{1}{2} ps$

$\frac{1}{2} 345\ \text{m}\ 272\ \text{m}$

$46\ 900\ \text{m}^{2}$

**13.**

$\frac{1}{3} Bh$

$\frac{1}{3} 76\ \text{cm}^{2}\ \ 130\ \text{cm}$

$250\ 293\ \text{cm}^{3}$

$V\ 2.510^{5}\ \text{cm}^{3}$

**14.**

$V \;\; Bh$

$29.0 \text{ cm}^{2} \; 11.2 \text{ cm}$

$V \; 9419.2 \text{ cm}^3$

$V \;\; 9420 \text{ cm}^3$

**15.**

$S \;\; ph$

$3 \; 1.092 \text{ m} \; 1.025 \text{ m}$

$S \; 3.358 \text{ m}^2$

**16.**

$S \;\; 2 \; rh$

$S \;\; 2 \frac{d}{2} \;\; h$

$250 \text{ mm} \; 347 \text{ mm}$

$S \; 272\,533 \text{ mm}^2$

$S \; 270\,000 \text{ mm}^2$

$S \; 2.7 \; 10^5 \text{ mm}^2$

**17.**

$V \;\; \frac{1}{2} \frac{4}{3} r^3$

$V \;\; \frac{2}{3} \frac{d}{2}^{3}$

$\frac{2 \; 0.83 \text{ cm}}{32}^{3}$

$0.14969$

$\text{cm}^3 \; V \; 0.15 \text{ cm}^3$

**18.**

To analyze the right triangle formed by the center of the pyramid base, the top of the pyramid, and any lateral facelength $s$, notice that the bottom of that triangle has width of half the square base side length.

$b \; \frac{22.4}{2} \; 11.2$

$h$ [redacted] $^2$ [redacted] $b^2$

[redacted] $^2$ [redacted] $11.2^2$

$h$ 8.72926 m

$\frac{1}{3} Bh$

$\frac{1}{3}$ 22.4 m $^2$ 8.72926 m

1459.998 $m^3$

$V$ 1460 $m^3$

**19.**

$s^2 \; h^2 \; r^2$

$s \; \sqrt{h^2 \; r^2}$

[redacted] $^2$ [redacted] $3.39^2$

$s$ 3.401055 cm $A$

$r^2 \; rs$

72.3 $cm^2$

**20.**

There are four triangles in this shape, all having the same area.

Using Hero's formula for each triangle:

$s \frac{1}{2}(a\ b\ c)$

$s \frac{1}{2}(3\ 3.67\ \text{dm})$

5.505 dm

$A$ [redacted] $(s\ a)(s\ b)(s\ c)$

[redacted] 3

[redacted] 3

$A$ 5.832205 $\text{dm}^2$

The total surface area A consists of four of these

triangles, $A$ 4 5.832205 $\text{dm}^2$

$A$ 23.3 $\text{dm}^2$

Or, we could determine the lateral side length $h$ (triangle heights) from the Pythagorean Theorem

$a^2 \quad h^2 \quad \frac{a}{2}^2$

$h$ [redacted] $^2 \quad \frac{3.67}{2}^2$

3.17831 dm

2

2(3.67 dm)(3.17831

dm) $A$ 23.3 $\text{dm}^2$

**21.**

$\frac{4}{3} r^3$

$\frac{4}{3} \frac{d}{2}^3$

$V \quad \frac{4}{3} \frac{d^3}{8}$

$V \frac{1}{6} d^3$

**22.**

$A \quad A_{\text{flat}} \quad A_{\text{curved}}$

$r^2 \frac{1}{4}$

$r2^2\ A\ r^2\ 2$

$r^2\ A\ 3\ r^3$

**23.**

Let $r$ radius of cone,

Let $h$ height of the cone

$$\frac{V}{V_{cone}} \quad \frac{2r^2 h}{\frac{1}{3} r^2 h}$$

$$\frac{V_{cylinder}}{V_{cone}} \quad \frac{2 r^2 h}{\frac{1}{3} r^2 h}$$

$$\frac{V_{cylinder}}{V_{cone}} \quad 6$$

**24.**

$A_{conebase} \quad \frac{1}{4} A$

$r^2 \quad \frac{1}{4}$ $\quad \frac{1}{}r^2 \quad rs$

$3 r^2 \quad rs \quad \frac{r}{} \quad \frac{1}{3}$

**25.**

$$\frac{A_{final}}{A_{original}} \quad \frac{4\ 2r^2}{4\ r^2}$$

$$\frac{A_{final}}{A_{original}} \quad \frac{16\ r^2}{4\ r^2}$$

$$\frac{A_{final}}{A_{original}} \quad 4$$

**26.**

weight density

volume $w$ $V$

$$w \ 9800 \ \frac{N}{m^3} 3.00 \text{ cm} \ \frac{1 \text{ m}}{100 \text{ cm}} \ 1.00 \text{ km}^2 \ \frac{1000 \text{ m}}{\text{km}}^2$$

$2.94 \ 10^8$ N

**27.**

$A \ A_{base} \quad A_{ends} \quad A_{sides}$

$A \ \ 2lw \ 2wh \ 2lh$

$A \ \ 2 \ 12.0 \ 9.50 \ 2 \ 9.50 \ 8.75 \ 2 \ 12.0 \ 8.75$

$A \ \ 604 \text{ cm}^2$

**28.**

The volume of pool can be represented by a trapezoidal right prism

$A_{trapezoid}$ $width$

$\frac{1}{2}$

$Vh\ b_1\ b_2\ w$

$\frac{1}{2}(24.0)\ 2.60\ 1.00\ (15.0)$

$648\ \text{m}^3$

**29.**

$V\ r^2 h$

$V\ \frac{d}{2}^2 h^2$

$\frac{0.76\ \text{m}^2\ 540\ 000\ \text{m}}{4}$

$244\ 969\ \text{m}^3$

$2.4\ 10^5\ \ \text{m}^3$

**30.**

There are three rectangles and two triangles in this shape. The triangles have hypotenuse

$c^2\ a^2\ b^2$

[redacted]$^2$[redacted]$4^2$

$c\ 5.00\ \text{cm}$

$A\ A_{rec\ \tan\ gles}\ A_{triangles}$

$(8.50)(5.00)\ (8.50)(3.00)\ (8.50)(4.00)\ 2\ \frac{1}{2}(4.00)(3.00)\ \ 2$

$114\ \text{cm}^2$

**31.**

$\frac{1}{3}BH$

$\frac{1}{3}230^2\ 150$

$2\ 645\ 000\ \text{m}^3$

$V\ 2.6\ 10^6\ \text{m}^3$

**28.**

**32.**

Use the Pythagorean Thoerem

$s^2 \quad h^2 \quad r^2$

$s \quad \sqrt{h^2 \quad r^2}$

[redacted] $4.60^2$

$s$ 10.0185 cm

$S \quad rs$

$S$ 4.60 cm 10.0185 cm

$S$ 145 cm$^2$

**33.**

$\frac{4}{3} r^3$

$\frac{4}{3} \frac{d}{2}^3$

$V \quad \frac{4}{3} \frac{50.3}{2}^3$

$V$ 66 635 m$^3$

$V$ 66 600 m$^3$

**34.**

$\frac{4}{3} r^3 \quad r^2 h$

$\frac{4}{3} 0.61^3 \quad 0.61^2 \; 1.98$

3.27 m$^3$

**35.**

The lateral side length can be determined from the Pythagorean Theorem

$s^2 \quad 8.0^2 \quad h^2$

[redacted] $40.0^2$

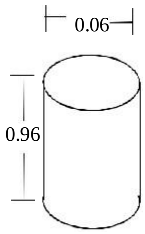
$s$ 40.792 mm

$x^2 \quad \frac{1}{2} ps$

$16^2 \quad \frac{1}{2} (4 \; 16)(40.792)$

1560 mm$^2$

**36.**




Let $n$ = number of revolutions of the lateral surface area $S$

$n S \;\; 76$

$n\, 2\, rh\; 76$

$$n \quad \frac{76}{2\,\frac{d}{2}\,h}$$

$$n \quad \frac{76}{dh}$$

$$n \quad \frac{76\text{ m}^2}{(0.60\text{ m})(0.96\text{ m})}$$

42 revolutions

**37.**

$2\, r$

$75.7 \;\; 2\, r$

$\frac{75.7}{2}$

$\frac{4}{3}\, r^3$

$$V \quad \frac{4}{3} \;\; \frac{75.7}{2} \quad ^3$$

$V \quad 7330\text{ cm}^3$

**38.**

$S \;\; 2\, rh$

$2\, \frac{d}{2}\, h$

$S \;\; dh$

(8.50 cm) 11.5 0.5 0.5

$S$ 334 cm$^2$

**39.**

$V\ V_{cylinder}\ V_{cone}$

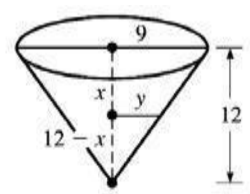
$V\ r^2_{cylinder} h_{cylinder}\ \frac{1}{3}\ r^2_{cone} h_{cone}$

$0.625/2^2\ 2.75\ \frac{1}{3}\ 1.25/2^2\ 0.625$

$1.09935\ \text{cm}^3$

$1.10\ \text{cm}^3$

**40.**




$\frac{}{12}\ \frac{y}{12\ x}$

$\frac{3}{4}\ 12\ x$

To achieve half the volume of the cone

$\frac{V_{cone}}{2}\ V_{fluid}$

$\frac{\frac{1}{3} r^2_{cone} h_{cone}}{2}\ \frac{1}{3} r^2_{fluid} h_{fluid}$

$\frac{\frac{1}{3} 9^2 12}{2}\ \frac{1}{3}\ \frac{3}{4} 12\ x^2\ 12\ x$

$\frac{9^2 12}{2}\ \frac{3}{4}\ 12\ x^2\ 12\ x$

$0.5625\ 12\ x^3$

$12\ x^3$

$\sqrt[3]{864}\ 12\ x$

$12\ \sqrt[3]{864}$

$2.48\ \text{cm}$

## Review Exercises

**1.**

*CGH* and given angle 148 are corresponding angles, so

*CGH* 148

*CGE* and *CGH* are supplementary angles so

*CGE CGH* 180

*CGE* 180 148

*CGE* 32

**2.**

*CGE* 32 from Question 1

*CGE* and *EGF* are complementary angles so

*CGE EGF* 90

*EGF* 90 32

*EGF* 58

**3.**

*CGE* 32 from Question 1

*CGE* and *DGH* are vertically opposite angles

*DGH* *CGE*

*DGH* 32

**4.**

*CGE* 32 from Question 1

*EGI* *CGE* 90

*EGI* 32 90

*EGI* 122

**5.**

$c^2$ $a^2$ $b^2$

[redacted] $^2$ [redacted] $40^2$

[redacted]

$c$ 41

**6.**

$c^2$ $a^2$ $b^2$

[redacted] $^2$ [redacted] $48^2$

[redacted]

$c$ 50

**7.**

$c^2 \quad a^2 \quad b^2$

$\sqrt{400^2 \quad 580^2}$

[redacted]

$704.55659815$

$c \; 700$

**8.**

$c^2 \quad a^2 \quad b^2$

$a^2 \quad c^2 \quad b^2$

$\sqrt{65^2 \quad 56^2}$

[redacted]

$a \; 33$

**9.**

$c^2 \quad a^2 \quad b^2$

$\sqrt{6.30^2 \quad 3.80^2}$

[redacted]

$7.357309291$

$c \; 7.36$

**10.**

$c^2 \quad a^2 \quad b^2$

[redacted]$^2$ [redacted] $25.1^2$

[redacted] $c$

$128.4757175 \; c$

$128$

**11.**

$c^2 \quad a^2 \quad b^2$

$a^2 \quad c^2 \quad b^2$

[redacted]$^2$ [redacted] $29.3^2$

[redacted] $a$

$21.088839 \; a$

$21.1$

**12.**

$c^2$ $a^2$ $b^2$

$b^2$ $c^2$ $a^2$

$0\sqrt{.885^2 \ 0.782^2}$

$0\sqrt{.171701}$ $b$

0.41436819 $b$

0.414

**13.**

3$s$

38.5 mm

$p$ 25.5 mm

**14.**

4$s$

4 15.2 cm

$p$ 60.8 cm

**15.**

$\frac{1}{2}bh$

$\frac{1}{2}$ 3.25 m 1.88 m

3.06 $m^2$

**16.**

$\frac{1}{2}$ $a$ $b$ $c$

$\frac{1}{2}$ 175 138 119

216 cm

$\sqrt{216\ 216\ 175\ 216\ 138\ 216}$

119 $A$ $\sqrt{216(41)(78)(97)}$

$\sqrt{67\ 004\ 496}$

8185.627404

$cm^2$ $A$ 8190 $cm^2$

**17.**

2 $r$

$c$ $d$

$c$ 98.4 mm

$c$ 309.1327171 mm

$c$ 309 mm

**18.**

$2l\ 2w$

$2\ 2.98\text{ dm}\ 2\ 1.86\text{ dm}$

$9.68\text{ dm}$

**19.**

$A\ \frac{1}{2}\ h\, b_1\, b_2$

$\frac{1}{2}\ 34.2\text{ cm}\ 67.2\text{ cm}\ 126.7\text{ cm}$

$3315.69\text{ cm}^2$

$A\ 3320\text{ cm}^2$

**20.**

$A\ r^2$

$A\ \frac{d}{2}^2$

$A\ \frac{d^2}{4}$

$A\ \frac{(32.8\text{ m})^2}{4}$

$844.9627601$

$\text{m}^2\ A\ 845\text{ m}^2$

**21.**

$V\ Bh$

$\frac{1}{2}\ bl\ h$

$\frac{1}{2}\ 26.0\text{ cm}\ 34.0\text{ cm}\ 14.0\text{ cm}$

$6188\text{ cm}^3$

$V\ 6190\text{ cm}^3$

**22.**

$V\ r^2 h$

$36.0\text{ cm}^2\ 2.40\text{ cm}$

$V\ 9771.60979\text{ cm}^3$

$V\ 9770\text{ cm}^3$

**23.**

$\frac{1}{3} Bh$

$\frac{1}{3}$ 3850 $m^2$ 125 m

160416.6667

$m^3$ $V$ 1.60 $10^5$ $m^3$

**24.**

$\frac{4}{3} r^3$

$V$ $\frac{4}{3}$ $\left(\frac{22.1 \text{ mm}}{2}\right)^3$

5651.652404 $mm^3$

$V$ 5650 $mm^3$

**25.**

$6s^2$

6 0.520 m

$^2$ $A$ 1.6224

$m^2$ $A$ 1.62 $m^2$

**26.**

$A$ 2 $r^2$ 2 $rh$

$A$ 2 $\frac{d}{2}^2$ 2 $\frac{d}{2}$ $h$

$A$ $\frac{d^2}{2}$ $dh$

$\frac{(1.20 \text{ cm})^2}{2}$ (1.20 cm)(5.80 cm)

24.12743158

$cm^2$ $A$ 24.1 $cm^2$

**27.**

$s^2$ $r^2$ $h^2$

$\sqrt{1.82^2 \; 11.5^2}$

[redacted]

$s$ 11.64312673 mm

$S$ $rs$

1.82 mm (11.64312673 mm)

$S$ 66.57188974 $mm^2$

$S$ 66.6 $mm^2$

**28.**

$4 r^2$

$A\ 4 \left(\frac{12\ 760 \text{ km}}{2}\right)^2$

$A$ 511 506 576 km$^2$

$A$ 5.115 10$^8$ km$^2$

**29.**

$BTA \ \frac{50}{2} 25$

**30.**

$TBA$ 90 since an angle inscribed in a semicircle is 90

$BTA$ 25 from Question 29

All angles in $BTA$ must sum to 180

$TAB\ BTA\ TBA$ 180

$TAB$ 180 90 25

$TAB$ 65

**31.**

$BTC$ is a complementary angle to $BTA$

$BTA$ 25 from Question 29

$BTC\ BTA$ 90

$BTC$ 90 25

$BTC$ 65

**32.**

$ABT$ 90 since any angle inscribed in a semi-circle is 90

**33.**

$ABE$ and $ADC$ are corresponding angles since $ABE \sim ADC$

$ABE \quad ADC$

$ABE$ 53

**34.**

$AD^2\ AC^2\ CD^2$

$AD \ \sqrt{(4\ 4)^2\ 6^2}$

$AD \ \sqrt{100}$

$AD$ 10

**35.**
since $ABE \sim ADC$

$$\frac{BE}{CD} \quad \frac{AB}{AD}$$

$$\frac{BE}{6} \quad \frac{4}{10}$$

$$BE \quad \frac{6(4)}{10}$$

$$BE \;\; 2.4$$

**36.**
since $ABE \sim ADC$

$$\frac{AE}{AC} \quad \frac{AB}{AD}$$

$$\frac{AE}{8} \quad \frac{4}{10}$$

$$AE \quad \frac{4(8)}{10}$$

$$AE \;\; 3.2$$

**37.**
base of triangle + hypotenuse of triangle + semicircle perimeter

$$p\ b \quad \sqrt{b^2 \quad 2a^2} \;\frac{1}{2}\; 2a$$

$$p\ b \quad \sqrt{b^2 \quad 4a^2} \;\; a$$

**38.**
$p$ perimeter of semicircle + 4 square lengths

$$\frac{1}{2}\; 2\ s\ 4s$$

$$p \;\; s\ 4s$$

**39.**
area of triangle + area of semicircle

$$A \;\; \frac{1}{2} b\ 2a \;\; \frac{1}{2}\; a^2$$

$$ab \;\; \frac{1}{2} a^2$$

**40.**
area of semicircle + area

square $A\ \frac{1}{2}s^2\ s^2$

**41.**

A square is a rectangle with four equal sides.

A rectangle is a parallelogram with perpendicular intersecting sides so a square is a parallelogram.

A rhombus is a parallelogram with four equal sides and since a square is a parallelogram, a square is a rhombus.

**42.**

If two triangles share two angles that are the same, then the third angle must also be the same in both triangles.

The triangles are similar to each other because they all have the same angles, and the sides must be proportional.

**43.**

$A \quad r^2$

If the radius of the circle is multplied by $n$, then the area of the new circle is:

$A \quad nr^2$

$(n^2 r^2)$

$A\ n^2 r^2$

The area of the circle is multiplied by $n^2$, when the radius is multplied by $n$.

Any plane geometric figure scaled by $n$ in each dimension will increase its area by $n^2$.

**44.**

$V \quad s^3$

If the length of a cube's side is multplied by $n$, then the volume of the new cube is:

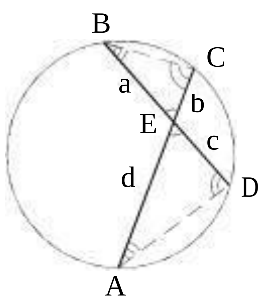
$V \quad ns^3$

$(n^3 s^3)$

$V\ n^3 s^3$

The volume of the cube is multiplied by $n^3$, when the length of the side is multplied by $n$.
This will be true of any geometric figure scaled by $n$ in all dimensions.

**45.**




$BEC \quad AED$, since they are vertically opposite angles

$BCA\ ADB$, both are inscribed in $AB$

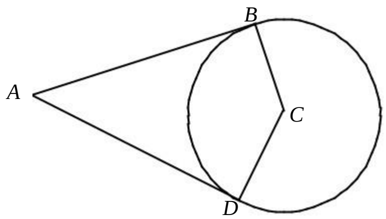
$CBD \quad CAD$, both are inscribed in $CD$

which shows $AED$ □$BEC$

$\underline{b}\ d$

$c$

**46.**




We are given $BAD$ 36.

The two angles $ABC$ and $ADC$ of the quadrilateral
at the point where the tangents touch the circle are each 90 .
The four angles of the quadrilateral will add up to 360 .

$ABC\ ADC\ BAD\ BCD\ 360$

$90\ 36\ BCD\ 360$

$BCD\ 144$

**47.**

The three angles of the triangle will add up to 180 .

If the tip of the isosceles triangle is 38 , find the other two equal angles.

2(base angle) 38 180

2(base angle) 142

base angle 71

**48.**

The two volumes are equal

$$V_{sphere}\ V_{sheet}$$

$$\frac{4}{3} r_{sphere}^3\ r_{sheet}^2 t$$

$$\frac{4}{3}\left(\frac{d_{sphere}}{2}\right)^3\ \left(\frac{d_{sheet}}{2}\right)^2 t$$

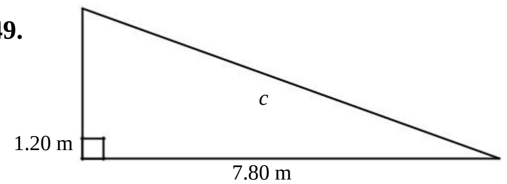
$$\frac{d_{sphere}^3}{6}\ \frac{d_{sheet}^2}{4} t$$

$$t\ \frac{2}{3}\frac{d_{sphere}^3}{d_{sheet}^2}\ \frac{2(1.50\text{ cm})^3}{3(14.0\text{ cm})^2}\ 0.011479591\text{ cm}$$

$t$ 0.0115 cm

The flattened sphere is 0.0115 cm thick.

**49.**




$c^2 \; a^2 \; b^2$

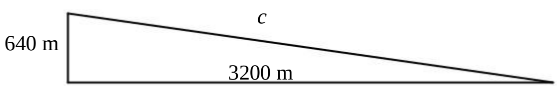
$\sqrt{[redacted] \text{ m}^2 [redacted] 7.80 \text{ m} [redacted]^2}$

$c \; \sqrt{62.28 \text{ m}^2}$

7.891767863 m

7.89 m

50.




$c^2 \; a^2 \; b^2$

$c \; \sqrt{640 \text{ m}^2 \; 3200 \text{ m}^2}$

$c_2 \; \sqrt{10\,649\,600 \text{ m}^2}$

3263.372489 m

$c$ 3300 m

**51.**

An equilateral triangle has 3 equal sides,

so all edges of the triangle and square are 2 cm

6 2 cm 12 cm

**52.**

Area of square + Area of 4 semi-circles

$A \; s^2 \; 4 \frac{r^2}{2}$

$A \; s^2 \; 2 r^2$

$A \; s^2 \; 2 \frac{s}{2}^2$

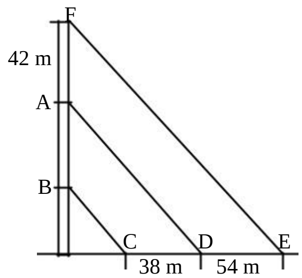
$A \; s^2 \; \frac{s^2}{2}$

$A \; (4.50 \text{ m})^2 \; \frac{(4.50 \text{ m})^2}{2}$

$52.05862562 \text{ m}^2$

$A$ 52.1 m$^2$

**53.**




Since line segments *BC*, *AD*, and *EF* are parallel,
the segments *AB* and *CD* are proportional to *AF* and *DE*

$$\frac{AB}{CD} \quad \frac{AF}{DE}$$

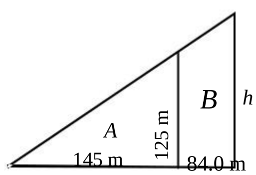
$$\frac{AB}{38\text{ m}} \quad \frac{42\text{ m}}{54\text{ m}}$$

$$AB \quad \frac{38\text{ m}\cdot 42\text{ m}}{54\text{ m}}$$

$AB$ 29.55555556 m

$AB$ 30 m

**54.**




Since the triangles are similar, their sides are proportional.

$$\frac{h}{145\ 84} \quad \frac{125}{145}$$

$$h \quad \frac{125(229)}{145}$$

$h$ 197.41379 m

Lot $A$ is a triangle

$$A_A \quad \frac{145\text{ m}\ 125\text{ m}}{2} \quad 9060\text{ m}^2$$

Lot $B$ is a trapezoid

$$A_B \quad 125\text{ m}\ 197.41379\text{ m}\ 84.0\text{ m}\ 13\ 500\text{ m}^2\ 2$$

**55.**

Since the triangles are proportional

$$\frac{BF}{AE} = \frac{MB}{AM}$$

$$\frac{BF}{1.6\text{ m}} = \frac{4.5\text{ m}}{1.2\text{ m}}$$

$$BF = \frac{4.5\text{ m} \cdot 1.6\text{ m}}{1.2\text{ m}}$$

$$BF = 6.0\text{ m}$$

**56.**

The triangles are proportional so,

$$\frac{DE}{BC} = \frac{AD}{AB}$$

$$\frac{DE}{33.0\text{ cm}} = \frac{16.0\text{ cm}}{24.0\text{ cm}}$$

$$DE = \frac{16.0\text{ cm}(33.0\text{ cm})}{24.0\text{ cm}}$$

$$DE = 22.0\text{ cm}$$

**57.**

The longest distance between points on the photograph is

$$c^2 = a^2 + b^2$$

$$\sqrt{(20.0\text{ cm})^2 + (25.0\text{ cm})^2}$$

$\sqrt{\text{[redacted]}\text{ cm}^2}$

$$32.01562119\text{ cm}$$

Find the distance in km represented by the longest measure on the map

$$x = 32.01562119\text{ cm} \times \frac{18\,450}{1} \times \frac{1\text{ m}}{100\text{ cm}} \times \frac{1\text{ km}}{1000\text{ m}}$$

$$x = 5.906882\text{ km}$$

$$x = 5.91\text{ km}$$

**58.**

$MA = \frac{r_L^2}{r_S^2}$

$d_L$ diameter of large piston in cm

$d_S$ diameter of small piston in cm

$MA = \frac{\left(\frac{d_L}{2}\right)^2}{\left(\frac{d_S}{2}\right)^2}$

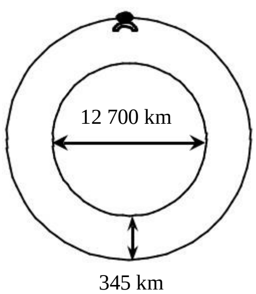
$MA = \left(\frac{d_L}{d_s}\right)^2$

$MA = \left(\frac{3.10}{2.25}\right)^2$

$MA = 1.898271605$

$MA = 1.90$

**59.**




The diameter of the satellite's orbit is Earth diameter plus two times its distance from the surface of Earth.

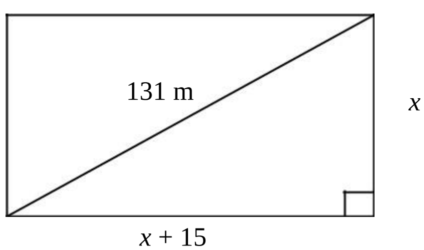
$c = \pi D$

$= \pi(12\ 700 \text{ km} + 2 \cdot 345 \text{ km})$

$c = \pi(12\ 700 \text{ km} + 690 \text{ km})$

$c = 42\ 100 \text{ km}$

**60.**



$A \; lw$

$x(\; x \; 15)$

$A \; x^2 \; 15x$

The diagonal is given, so

$a^2 \quad b^2 \quad c^2$

$(\; x \; 15)^2 \quad x^2 \; 131^2$

$x^2 \;\; 30\, x \; 225 \;\; x^2 \quad 17161$

$2\, x^2 \;\; 30\, x \; 16936$

The left side is twice the area!

$2(\; x^2 \;\; 15x) \;\; 16936$

$2\, A \; 16936$

$\frac{16936}{2}$

$8470 \text{ m}^2$

**61.**

Area of the drywall is the area of the rectangle subtract the two circular cutouts.

$A \;\; lw \; 2 \; r^{\,2}$

$A \;\; lw \; 2 \;\; \frac{d^{\,2}}{4}$

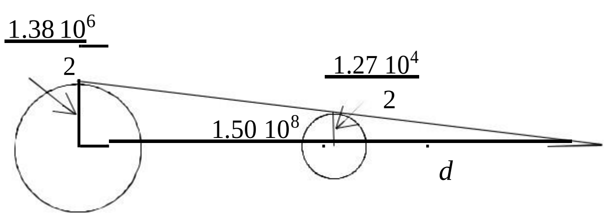
$A \;\; lw \;\; \frac{d^{\,2}}{2}$

$A \; 1200 \text{ mm } 2400 \text{ mm} \;\; \frac{(350 \text{ mm})^2}{2}$

$2\;687\;577.45 \text{ mm}^2$

$2.7 \;10^6 \;\; \text{mm}^2$

**62.**



The triangles are similar so,

$$\frac{\frac{12\,700}{2}}{d\ 150\,000\,000} \quad \frac{\frac{1\,380\,000}{2}}{}$$

$$\frac{}{6350} \quad \frac{d\ 150\,000\,000}{690\,000}$$

$$690\,000\, d \;\; 6350\, d\ 150\,000\,000$$

$$690\,000\, d \;\; 6350\, d\ 952\,500\,000\,000$$

$$683\,650\, d \;\; 952\,500\,000\,000$$

$$\frac{952\,500\,000\,000}{683\,650}$$

$$1\,393\,256.783 \text{ km}$$

$$d\ 1.39\ 10^6 \text{ km}$$

**63.**

$$A \quad \frac{h}{3}\ y_0\ \ 4y_1\ \ 2y_2\ \ 4y_3\ \ldots\ 2y_{n\,2}\ \ 4y_{n\,1}\ \ y_n$$

$$A \quad \frac{250}{3}\ \ 220\ 4530\ 2\ 480\ 4\ 320\ 190\ 260 \\ 2\ 510\ 4350\ 2\ 730\ 4\ 560\ 240$$

$$A \quad \frac{250}{3} \quad (12\,740)$$

$$1\,061\,666 \text{ m}^2$$

$$1.110^{\ 6} \ \text{m}^2$$

**64.**

$$V \quad \frac{h}{2}\ y_0 \quad 2y_1 \quad 2y_2 \quad \ldots 2y_{n\,1} \quad y_n$$

$$\frac{250}{2}\ 560\ 2\ 1780\ 2\ 4650\ 2\ 6730\ 2\ 5600\ 2\ 6280\ 2\ 2260\ 230$$

$$\frac{250}{2}\ (55\,390)$$

$$6\,923\,750 \text{ m}^3$$

$$V\ 6.92\ 10^6 \text{ m}^3$$

**65.**

$$V \quad r^2 h$$

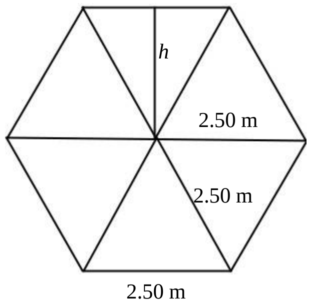
$$\frac{d^2}{4} h$$

$$V \quad \frac{(4.32 \text{ m})^2}{4}\ 13.2 \text{ m}$$

$$193.47787$$

$$\text{m}^3\ V\ 193 \text{ m}^3$$

**66.**




Area of cross-section is the area of six equilateral triangles with sides of 2.50 m each Using Hero's formula,

$s\ \frac{1}{2}(a\ b\ c)$

$s\ \frac{1}{2}(2.5\ 2.5\ 2.5)$

3.75 m

$A$ [redacted] $\sqrt{(s\ a)(s\ b)(s\ c)}$

[redacted] $2.5)^3$

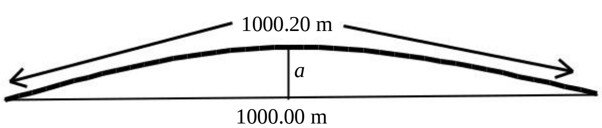
$A$ 2.70633 m$^2$

$V$ area of cross section height

109.6063402 m$^3$

1.10 10$^2$ m$^3$

**67.**




$c^2\ a^2\ b^2$

$a^2\ c^2\ b^2$

[redacted] m [redacted] 500.00 m [redacted]

[redacted] m$^2$

$a$ 10.000 m

**68.**

distance apart in km $c^2\ a^2\ b^2$

$\sqrt{2.4\ \text{km}^2\ \ 3.7\ \text{km}^2}$

[redacted] km$^2$

4.410215414 km

$c$ 4.4 km

**69.**

$V \; V_{cylinder} \; V_{dome}$

$V \;\; r^2 h \frac{1}{2} \frac{4}{3} r^3$

$0.380 \text{ m}^2 \; 2.05 \text{ m} \; 0.380 \text{ m} \frac{2}{3} 0.380 \text{ m}^3$

$0.872512433 \text{ m}^3$

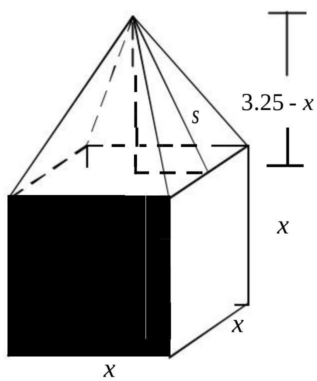
Convert $\text{m}^3$ to L,

$0.872512433 \text{ m}^3 \; \frac{1000 \text{ L}}{\text{m}^3}$

$872.512433$

L $V$ 873L

**70.**




Given $x \;\; 2.50$ m

Find the lateral height $s$ of the pyramid's triangles

$s^2 \;\; a^2 \;\; b^2$

$s^2 \;\; 3.25 \;\; x^2 \; \frac{x}{2}^2$

$s^2 \;\; 0.75 \text{ m}^2 \; 1.25 \text{ m}^2$

$\sqrt{2.125 \text{ m}^2}$

$1.457737974 \text{ m}$

tent surface area = surface area of pyramid + surface area of cube tent surface area = 4 triangles + 4 squares

$2(2.50 \text{ m})(1.457738 \text{ m}) \; 4 \; 2.50 \text{ m}^2$

$A \; 32.2887 \text{ m}^2$

$A \; 32.3 \text{ m}^2$

**71.**

$\frac{16}{9}$

$w \; \frac{16h}{9}$

$107^2 \;\; w^2 \;\; h^2$

$11\,449 \; \frac{16h}{9} \; - \; ^2 \; h^2$

$11\,449 \; \frac{256}{81} h^2 \;\; h^2$

$11\,449 \; \frac{337}{81} h^2$

$h^2 \; \frac{81(11449)}{337}$

$\sqrt{2751.836795 \text{ cm}^2}$

$h$ 52.457952645 cm $h$

52.5 cm

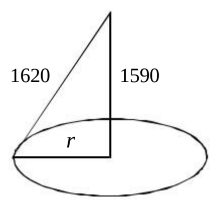
$\frac{16h}{9}$

$w \; \frac{16 \; 52.457952645 \text{ cm}}{}$

93.25858247 cm

$w$ 93.3 cm

**72.**




$r^2 \;\; 1620^2 \;\; 1590^2$

$r^2$ 96 300 km$^2$

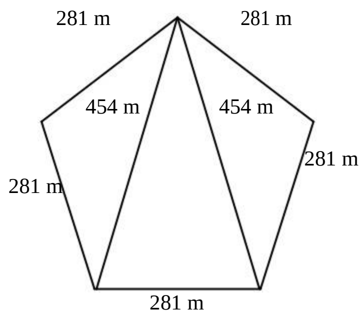
$A \;\; r^2$

(96 300 km$^2$ )

302 535.3725 km$^2$ $A$

303 000 km$^2$

**73.**




The area is the sum of the areas of three triangles, one with sides 454, 454, and 281 and two with sides 281, 281, and 454. The semi-perimeters are given by

$s_1 = \frac{281 + 281 + 454}{2} = 508$

$s_2 = \frac{454 + 454 + 281}{2} = 594.5$

$A = 2\sqrt{508(508-281)(508-281)(508-454)} + \sqrt{594.5(594.5-454)(594.5-454)(594.5-281)}$

$A = 136\ 000\ \text{m}^2$

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