TSSM™
Creating VCE Success

FURTHER MATHEMATICS
Teach Yourself Series
Topic 11: Measurement and Trigonometry

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Geometry

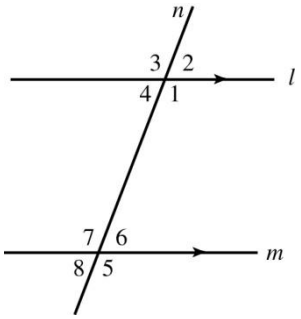
This area of study is important in many professions that use geometrical concepts and associated techniques- for example, architecture, navigation and art. It is a helpful tool to describe shapes of objects, directions on a car trip or design of a house.

Basic geometry

As it appears in Unit 2

- Point – marker for a location in space
- Line segment – two points connected
- Ray – line segment extended to infinity in one direction
- Line – line segment extended to infinity in both directions
- Angle – where two lines meet
- Parallel – two lines that never meet
- Perpendicular – two lines that cut each other at 90°
- Transversal – a line intersecting a pair of parallel lines
    - ♦ Corresponding angles are equal
    - ♦ Co-interior angles add up to 180°
    - ♦ Alternate angles are equal
- Vertically opposite angles – angles formed by two intersecting lines (are equal)
- Supplementary angles – add up to 180°
- Complementary angles – add up to 90°
- Polygon – closed figure made up of 3 or more line segments
- Sum of interior angles of a polygon - $S = (n-2)\times 180°$ where n is the no. of sides
- Regular polygon – polygon with equal sides/angles
- Interior angle of a regular n-sided polygon - $\frac{(n-2)\times 180°}{n}$
- Triangle – polygon with 3 sides
    - ❖ Sum of angles in a triangle is 180°
    - ❖ Circumcentre – where the perpendicular bisectors of a triangle meet
    - ❖ Centroid – point where the lines connecting each vertex with the midpoint of the opposite sides meet
    - ❖ Incentre – where the angle bisectors of each vertex meet
    - ❖ Scalene – triangle with no equal sides
    - ❖ Isosceles – triangle with two sides equal
    - ❖ Equilateral – triangle with all sides/angles equal

Example. For the following figure, if angle 3 is 105° answer **a** to **e** giving reasons



a. Find the value of angle 2

180° - 105° = 75° (linear pair add up to 180°)

b. Find the value of angle 1

105° (vertically opposite angles)

c. Find the value of angle 6

75° (angles 2 & 6 are corresponding angles)

d. Find the value of angle 8

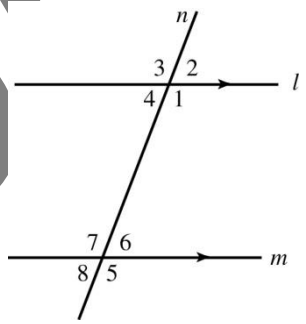
75° (angles 6 & 8 are vertically opposite angles)

e. Find the value of angle 5

180° - 75° = 105° (linear pair)

Review Questions

1. Consider the following figure –



a. Write down pairs of angles which are vertically opposite

b. Write down pairs of angles which are co-interior

_____

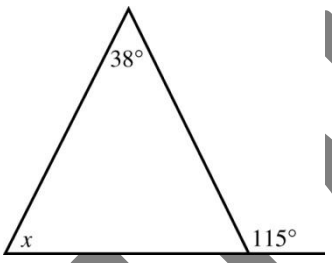
c. Write down pairs of angles which are alternate

_____

d. Write down pairs of angles which are corresponding

_____

2. From the following figure –



a. Find the angle marked *x*

_____

b. Name the kind of triangle

_____

3. Angles that add up to 180° are called

A. Obtuse angles
B. Reflex angles
C. Vertically opposite angles
D. Complementary angles
E. Supplementary angles

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Solutions to Review Questions

1.

a. 1 & 3; 2 & 4; 5 & 7; 6 & 8

b. 4 & 7; 1 & 6

c. 4 & 6; 1 & 7

d. 2 & 6; 3 & 7; 4 & 8; 1 & 5

2.

a. $115° = x + 38°$
$x = 115° - 38° = 77°$

b. Scalene triangle

3. *Answer:* E

4. *Answer:* B

Explanation:

$S = (n-2)\times 180° = (6-2) \times 180° = 4 \times 180° = 720°$

5.

a. 5 + 6 + 8 = 19cm

b. $A = \sqrt{s(s-a)(s-b)(s-c)} = \sqrt{9.5(9.5-8)(9.5-6)(9.5-5)} = 15cm^2$

6.

a. Trapezium

b. $A = \frac{1}{2}(10+12)\times 7 = 77cm^2$

7.

a. 2(lw + wh + lh)

b. $2(15 \times 9 + 9 \times 7 + 15 \times 7) = 606\ m^2 = 6060000\ cm^2$

c. $15 \times 9 \times 7 = 945\ m^3$

8.

a. Triangular prism

b. $TSA = \left(2 \times \frac{1}{2} \times 3 \times 4\right) + (5 \times 12) + (3 \times 12) + (4 \times 12) = 156 cm^2$

c. $V = \frac{1}{2} \times 3 \times 4 \times 12 = 72\ cm^3$

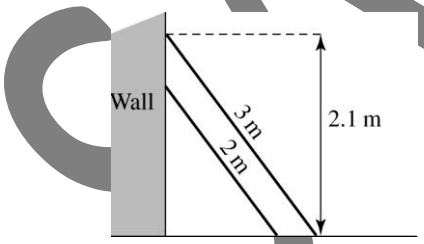
9. *Answer:* E

Explanation:

$V = \frac{1}{2} \times \frac{4}{3} \times \pi \times 7.5^3 = 281.25\pi$

10.

a.



b. $\frac{x}{2} = \frac{2.1}{3} \Rightarrow x = 1.4m$

11. *Answer:* D

Explanation:

Volume scale factor = 2 : 1

Length scale factor = $\sqrt[3]{2}:1$

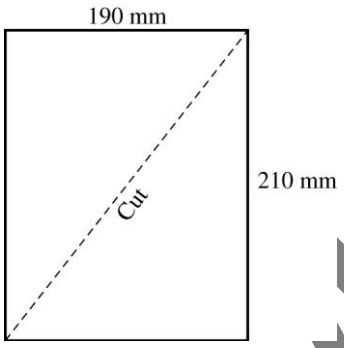
12. *Answer:* A

Explanation:

$$\frac{volume\,of\ water}{volume\,of\ air}=\frac{\frac{1}{3}\times\pi\left(\frac{r}{2}\right)^2\left(\frac{1}{2}h\right)}{\frac{1}{3}\times\pi r^2h-\frac{1}{3}\times\pi\left(\frac{r}{2}\right)^2\left(\frac{1}{2}h\right)}=\frac{1/8}{7/8}=\frac{1}{7}$$

13.

a.



b.

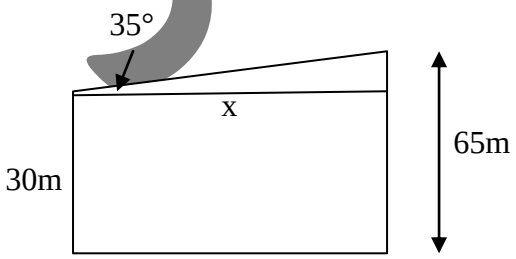
$$\text{Length of diagonal} = \sqrt{210^2+190^2}$$
$$\approx 283.196\,\text{mm}$$

c.

$$\text{Length of width} = \sqrt{490^2-190^2}$$
$$\approx 451.664\,\text{mm}$$

14.

a.



b. tan(35°) = 35/x which gives x = 50m

c. 35° (it is the same as the angle of elevation)