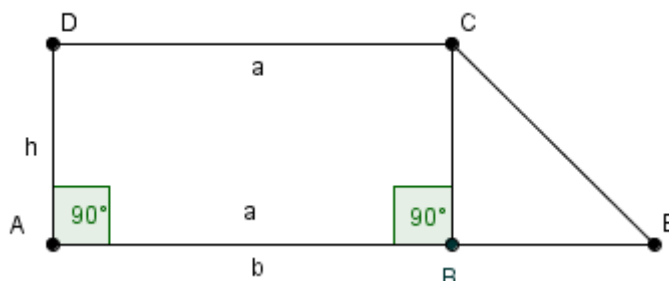## Student Activity: To investigate the Trapezoidal Rule

**Use in connection with the interactive file, 'Trapezoidal Rule Semi Circle' on the student's CD.**

1.



**Note *a* is the length of AB and *b* is the length of AE.**

a. Given that |AB| = |DC| and that AE is a line segment, name the two geometric shapes which together make up the figure AECD.

_____

_____

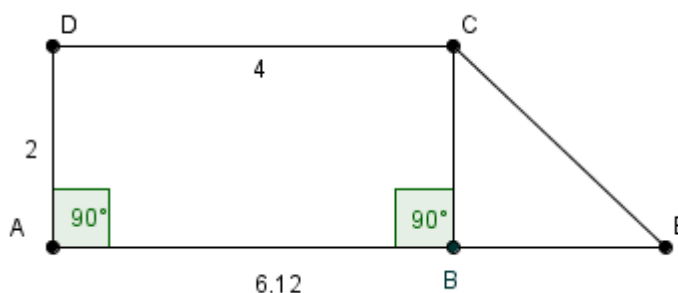b. What is the area of ABCD in terms of a and h?

_____

_____

c. What is the area of BCE in terms of a, b and h?

_____

_____

d. What special name is given to the quadrilateral AECD?  If you don't know, see page 8 of the *formulae and tables* booklet.

_____

_____

e. What is the area of AECD? Show your calculations.

_____

_____

f. Look at your *formulae and tables* booklet page 8 and check the formula there. Does your answer in part **e** agree with it?

_____

_____

g. Find the area of this trapezium.
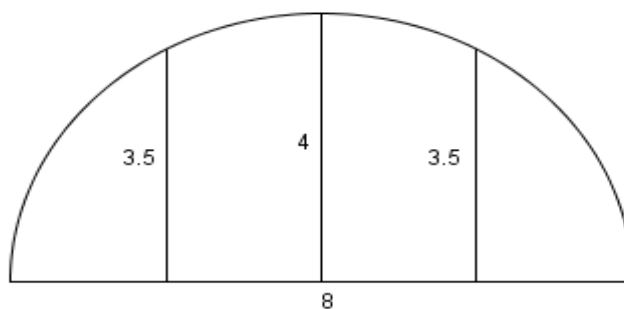


**Note: |AE| = 6.12**

_____

_____

h. Is the figure AECD a trapezium? Explain your answer.



**Note:  b is the length of AE and BC is perpendicular to AE.**

_____

_____

i. What is the area of the above shape in terms of a, b and h.

_____

_____

2. Using the fact that the vertical lines in the semi circle are equally spaced, find the approximate area of this semi circle using triangles and trapeziums.

_____

_____



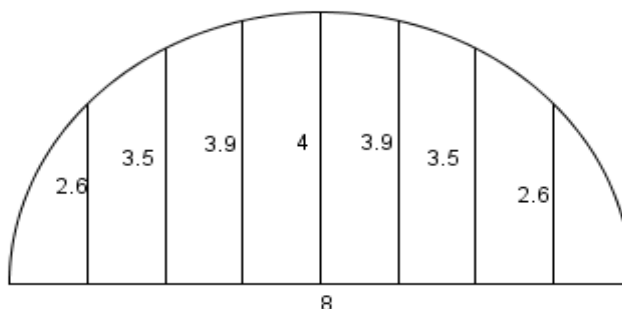3. Using the fact that the vertical lines in the semi circle are equally spaced, find the approximate area of this semi circle using triangles and trapeziums.

_____

_____
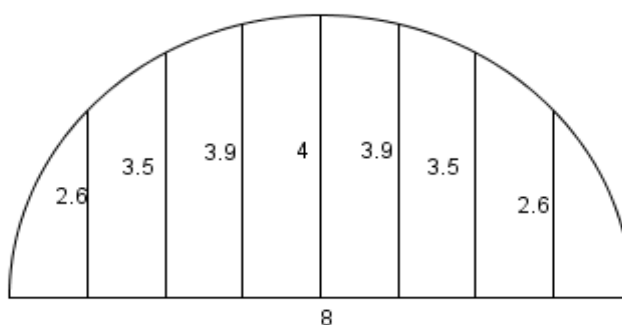


4. Use the Trapezoidal Rule in your *formulae and tables* to find the area of this semi circle below.

_____

_____

5.  Without using the formula for the area of a semi circle, how would you get a more accurate answer than the answer you got in the previous question?

    _____

    _____

6.  Use 3.14 as π to find the area of the semi circle below.  Now compare your answer to the answers you got for Q.4 and Q.5.

    _____

    _____



4

8

7.  Using the fact that the vertical lines in the semi circle are equally spaced, find the approximate area of this semi circle using triangles and trapeziums.
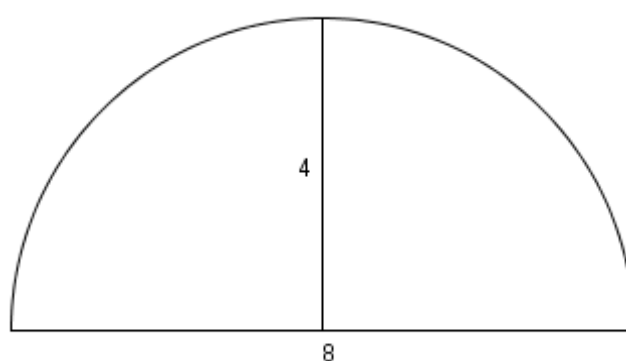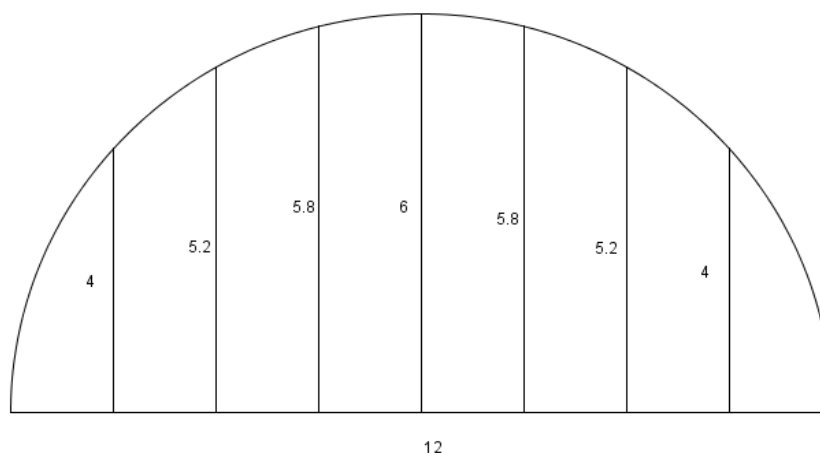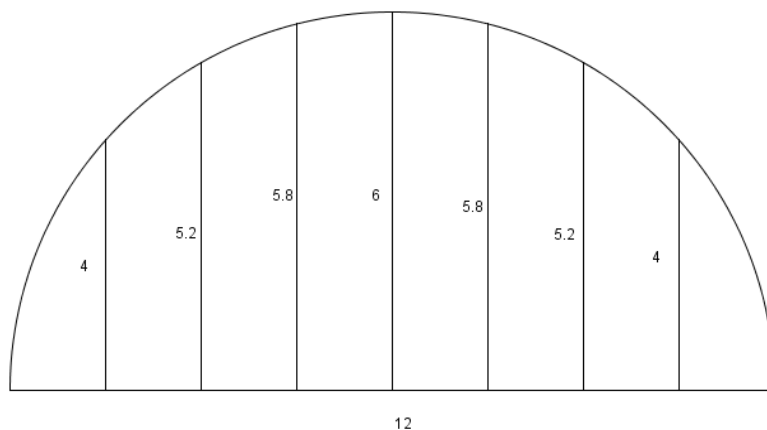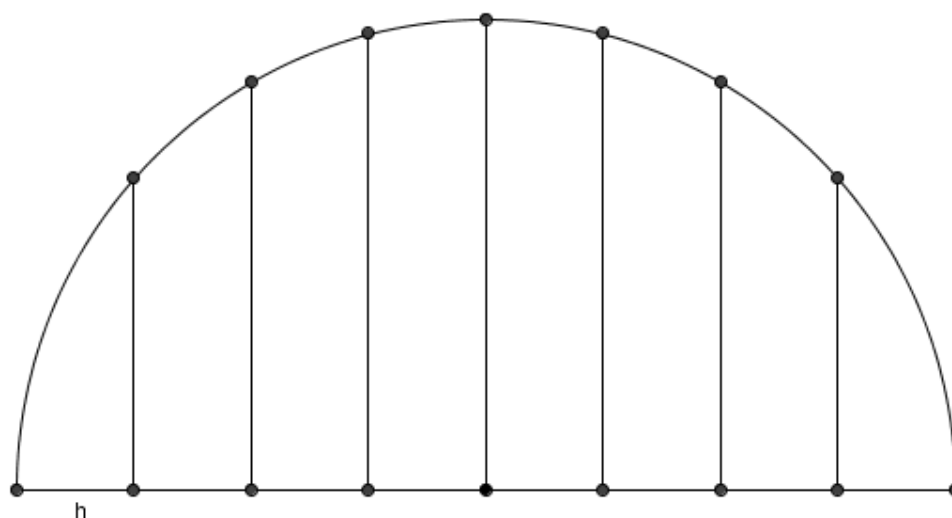
    _____

    _____



5.8   6   5.8

5.2      5.2

4          4

12

8.  Use the formula for the Trapezoidal Rule found in your *formulae and tables* booklet to find the area of the semi circle below.

_____

_____



9.   By measuring with your ruler, find the approximate area of the semicircle below by estimating  it with trapeziums and triangles.  Use the table below and use a and b as the lengths of the parallel sides in the trapeziums. (The triangles at each end can be treated as trapeziums with one parallel side of zero length.)
Shade in the area you are "missing" when you do this.

_____

_____

| Shape | a | b | h | $A = h(\dfrac{a+b}{2})$ |
|-------|---|---|---|----------|
| 1 | 0 | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| Total Area of all the trapeziums and triangles | | | | |

a.  **Use the formula** :  Area of a semicircle  $A = \dfrac{\pi r^2}{2}$ =  _____

b.  What is the error in using the approximation with the trapeziums and triangles:

_____

c.  What is the % error in using this approximation?_____

d.  How could the approximation be improved? _____

**Higher Level**

10. Deriving the formula for the Trapezoidal Rule ( for 6 intervals)
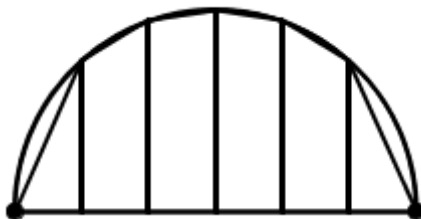


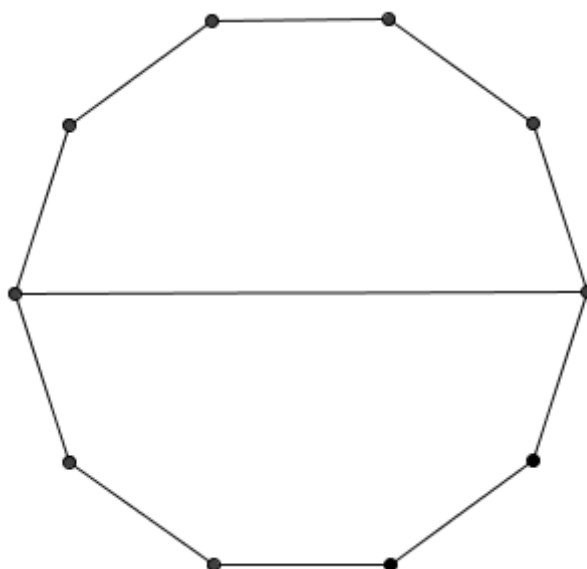Instead of giving measurements for the parallel sides of the trapezium, label them as $y_1$, $y_2$, etc.

| Shape | a | b | h | $A = h(\dfrac{a+b}{2})$ |
|-------|-----|-----|---|-------------------------|
| 1 | $y_1$ | $y_2$ | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | $y_7$ | | |

Total area =

_____

_____

Simplify this formula:

_____

_____

Can you generalise this formula for dividing a shape into any number of trapeziums of equal $h$ where the last side is of length $y_n$?

_____

_____

11. Use measurement and the Trapezoidal Rule to find the approximate area of the following shape in cm$^2$.

_____

_____



12. Use measurement and the Trapezoidal Rule to find the approximate area of the following shape in cm$^2$.

_____

_____

_____

_____