**Area, perimeter, volume**

1. Prior knowledge

    (a) Area: rectangle, square, triangle, parallelogram; area and perimeter (formula sheet)

    (b) Solve for parameter versus calculate result

2. Distance on the coordinate plane

    (a) Plotting, labeling points, etc.

    (b) Horizontal & vertical distances

    (c) Perimeter calculation

    (d) Pythagorean formula

    (e) Applications: Rhombus, isosceles $\triangle$,

    (f) Radicals, $\pi$ and rounding

3. Volume: prism, cylinder, cone

    (a) Compound shapes (including margins)

    (b) Surface area

4. Circle area and circumference

    (a) Sector areas, arc length

    (b) Radian / degree conversion

5. Scaling shapes (eg. rectangle, triangles including midline)

6. Regents problems, January 2017, #26, 34, 29? (basic shapes)

**Horizontal and vertical measure**

1. Given the quadrilateral $ABCD$ with $A(1,2)$, $B(6,2)$, $C(6,5)$, and $D(1,5)$.

    (a) Plot and label $ABCD$ on the grid.

    (b) Find the lengths of the sides by counting on the graph or subtracting coordinates. Complete the table.

    (c) Definition: Perimeter is the total distance around a shape.

    Add up the perimeter of $ABCD$, entering it to the bottom of the table of lengths.
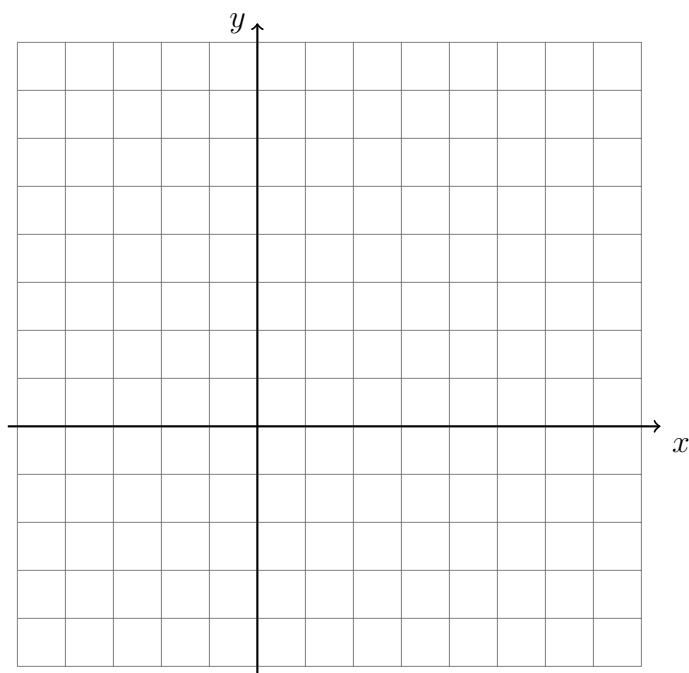
| Side | Length |
|------|--------|
| $AB$ | |
| $BC$ | |
| $CD$ | |
| $AD$ | |
| Total | |

    (d) Definition: Area is the number of unit squares in a shape.

    Find its area by counting the number of squares in $ABCD$ or use multiplication as a short cut.

2. The rectangle $ABCD$ is shown below with length $l = 12$ and width $w = 5$. Label the sides of the rectangle with their lengths.

   (a) Calculate the perimeter and enter it in the table.

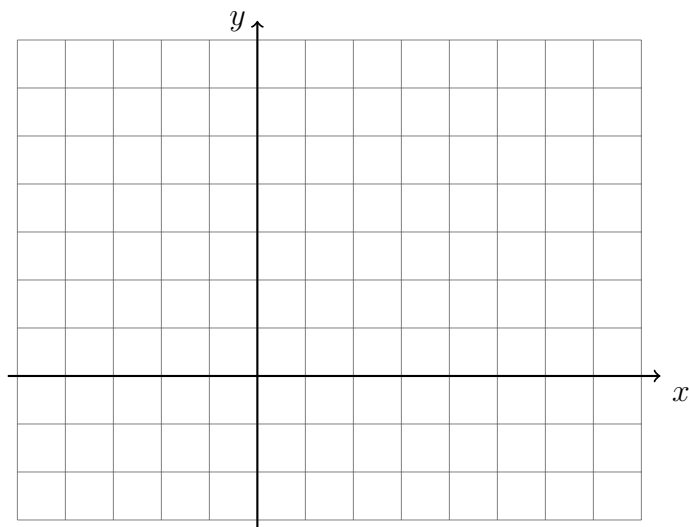   (b) Find the area of the rectangle. (show the work as an algebra equation)

| Side | Length |
|------|--------|
| $AB$ | 12 |
| $BC$ | 5 |
| $CD$ | 12 |
| $AD$ | 5 |
| Perimeter | |

3. Given the quadrilateral $BECA$ with $B(-3, -2)$, $E(5, -2)$, $C(5, 5)$, and $A(-3, 5)$.

   (a) Plot and label $BECA$ on the grid.

   (b) Find the lengths of the sides and complete the table.

   (c) Calculate the perimeter and enter it in the table.

| Side | Length |
|------|--------|
| $BE$ | |
| $EC$ | |
| $CA$ | |
| $AB$ | |
| Total | |

   (d) Find the area of $BECA$.

### Diagonal distance on the coordinate plane

4. Given $P(-2, 9)$ and $Q(3, -3)$, find the length of $\overline{PQ}$.

### Distance on the coordinate plane: proofs

5. Triangle $ABC$ has vertices with coordinates A(,), B(,), and C(,). Prove that $\triangle ABC$ is an isoscelese triangle but not an equilateral triangle. (The use of the set of axes below is optional.)
   Note: state both conclusions for full credit.

6. Triangle $\triangle TEN$ is graphed on the set of axes below. The vertices of $\triangle TEN$ have the coordinates $T(-1, -2)$, $E(8, 1)$, and $N(3, 6)$.
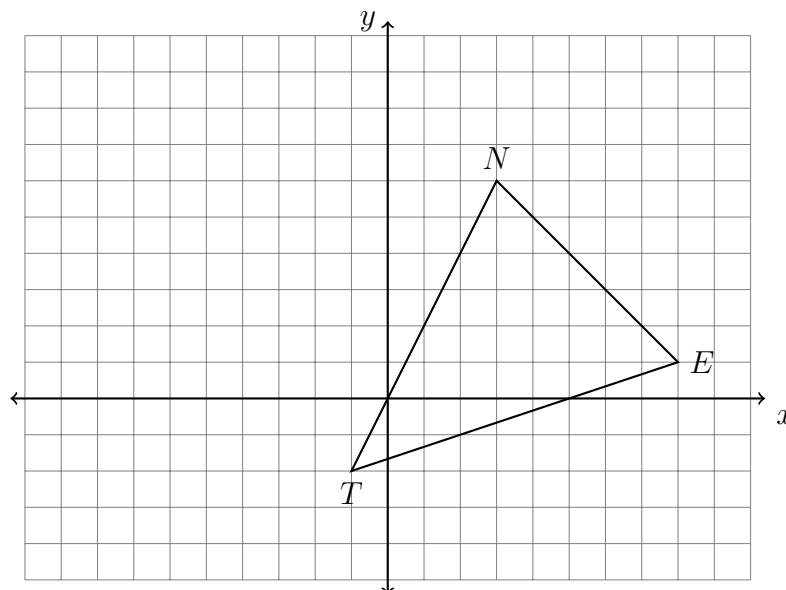


   (a) Draw an altitude through point $N$ perpendicular to $\overline{TE}$.
   (b) What is the length of the altitude drawn through $N$?
   (c) What is the length of the base, $TE$?
   (d) Find the area of $\triangle TEN$.

7. Given the quadrilateral $RSTU$ with $R(1, 3)$, $S(4, 7)$, $T(4, 2)$, and $U(1, -2)$.

   (a) Plot and label $RSTU$ on the grid.
   (b) Using the distance formula or otherwise, calculate $RS$, $ST$, $TU$, and $RU$.
   (c) Definition: If a quadrilateral has four congruent sides, then it is a rhombus.

      Prove that $RSTU$ is a rhombus.
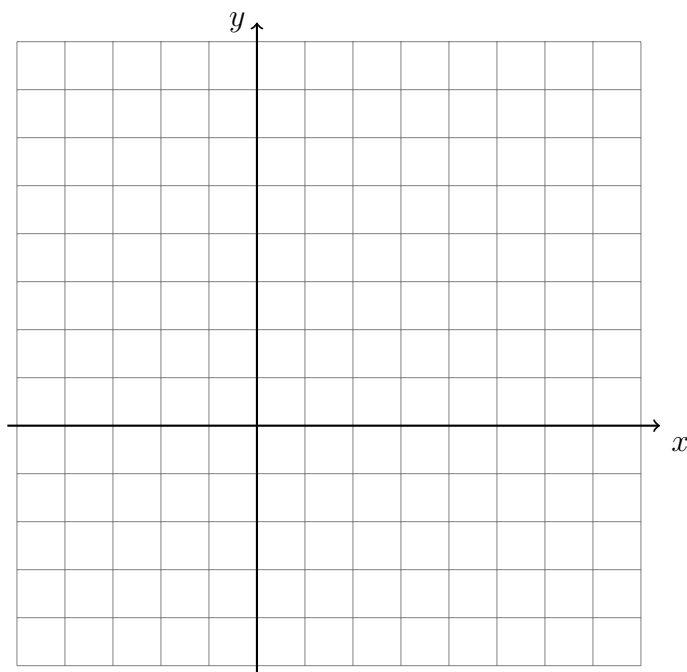
8. Given the quadrilateral $RECT$ with $R(-4, 1)$, $E(8, 1)$, $C(8, 6)$, and $T(-4, 6)$.

   (a) Plot and label $RECT$ on the grid.

   (b) Using the distance formula, calculate the length of the two diagonals $RC$ and $ET$.

   (c) Theorem: If the diagonals of a quadrilateral are congruent, then it is a rectangle.

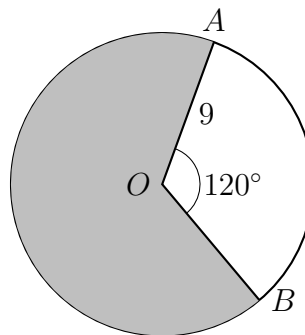      Prove that $RECT$ is a rectangle.
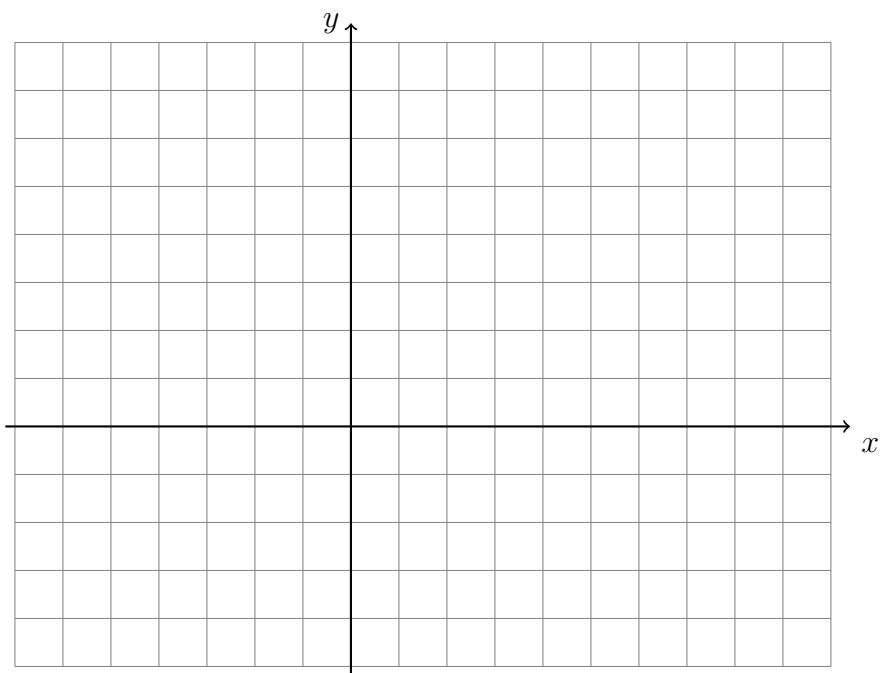
**Circle area and circumference**

9. The diagram below shows the circle $O$ with radii $\overline{OA}$ and $\overline{OB}$. The measure of angle $AOB$ is 120°, and the length of a radius is 6 inches.
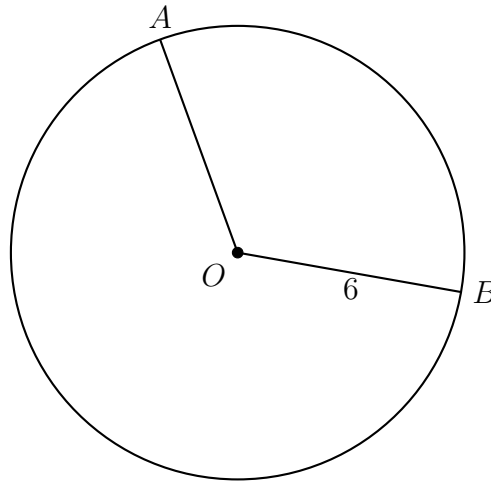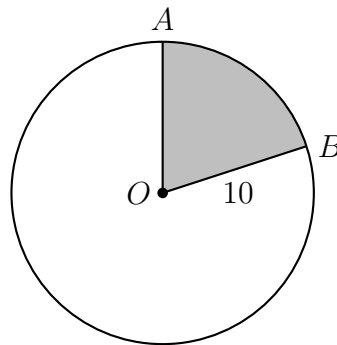


Which expression represents the length of arc $AB$, in inches?

(a) $\dfrac{120}{360}(6\pi)$

(c) $\dfrac{1}{3}(36\pi)$

(b) $120(6)$

(d) $\dfrac{1}{3}(12\pi)$

10. Circle O with a radius of 9 is drawn below. The measure of central angle AOC is 120°.
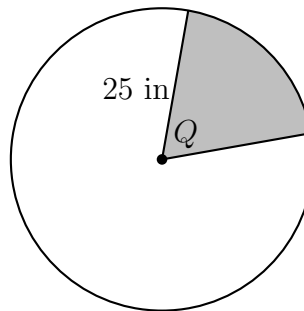


What is the area of the shaded sector of circle $O$?

(a) $6\pi$                                    (c) $27\pi$

(b) $12\pi$                                   (d) $54\pi$

11. In the diagram below, circle O has a radius of 10.

If $m\widehat{AC} = 72°$, find the area of shaded sector AOB, in terms of $\pi$.

12. In the diagram below, the circle has a radius of 25 inches. The area of the *unshaded* sector is $500\pi$ in$^2$.
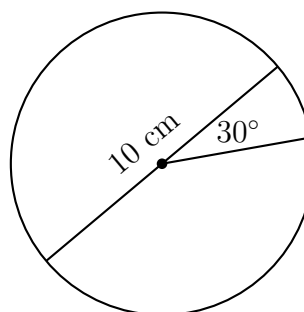


Determine and state the degree measure of angle $Q$, the central angle of the shaded sector.

13. The area of a sector of a circle with a radius measuring 15 cm is $75\pi$ cm$^2$. What is the measure of the central angle that forms the sector?

(a) 72°                                    (c) 144°

(b) 120°                                   (d) 180°

14. A circle with a diameter of 10 cm and a central angle of 30° is drawn below.



What is the area, to the *nearest tenth of a square centimeter*, of the sector formed by the 30° angle?

(a) 5.2

(c) 6.5

(b) 13.1

(d) 26.2