A) THE PYTHAGOREAN THEOREM

The Pythagorean Theorem is used to find the missing side of a right triangle. Remember, the longest side “c” is always across from the ______ angle.

The Pythagorean Theorem:

\[ a^2 + b^2 = c^2 \]

Ex. Find \( a \).

This is a “special” case where you can just use multiples: 3 – 4 – 5

If you are lucky enough to get a triangle made up of these multiples, then you can do the problem in your head!
1) Find the length of AB in the right triangle below.

2) What is the length of a diagonal of a rectangle of length 30 and width 40?
   a) 38  b) 45  c) 48  d) 50  e) 52

3) What is the length of a diagonal in the rectangle above?
   a) 10.3  b) 10.8  c) 11.2  d) 11.5  e) 12
LESSON 3 – GEOMETRY

4) In right triangle ABC, \( AB = 20 \) and \( BC = 20 \). Approximately how long is \( AC \)?

![Right triangle ABC with sides AB = 20 and BC = 20.](image)

a) 20  

b) 24  

c) 26  

d) 28  

e) 30  

**Shortcut:** If the 2 legs of a right triangle are the same, the hypotenuse will ALWAYS be equal to a leg times \( \sqrt{2} \).

5) What is the length of the diagonal in the square above?

![Square with diagonal labeled 93.](image)

a) 93  

b) \( 93\sqrt{2} \)  

c) \( 93\sqrt{3} \)  

d) 186  

e) \( 186\sqrt{2} \)
6) What is the distance of point Q from the origin?

a) $2\sqrt{13}$  

b) $5\sqrt{17}$  
c) $3\sqrt{11}$  
d) $5\sqrt{37}$  
e) $2\sqrt{41}$

7) A 50 ft. ladder is leaning up against a wall as shown in the drawing above. If the ladder slips down the wall 8 feet, how much further will the base of the ladder now be from the wall?
B) ANGLE & TRIANGLE RELATIONSHIPS

The sum of the angles of a triangle is ALWAYS _______.

Angles that form a straight line have a sum of _______°

Vertical angles (straight across from each other when two lines intersect) are equal.

If \( \angle ABD = 120° \), then \( \angle DBC = _______ \)?

If 2 sides of a triangle are equal, then the ____________ opposite those sides are also equal.

An exterior angle of a triangle is equal to the sum of the two remote interior angles.
1) Which of the following could be the measures of angles of a triangle?

   a) $20^\circ, 25^\circ, 140^\circ$  
   b) $50^\circ, 60^\circ, 75^\circ$  
   c) $20^\circ, 80^\circ, 80^\circ$  
   d) $100^\circ, 45^\circ, 45^\circ$  
   e) $35^\circ, 55^\circ, 85^\circ$

2) Find the measure of $x$ in the picture below:

   a) $21^\circ$  
   b) $31^\circ$  
   c) $117^\circ$  
   d) $96^\circ$  
   e) $147^\circ$

3) In the diagram above, if $a = 115$ degrees, what is $b$?

4) What is the value of $x$ in the picture above?

   a) $37$  
   b) $48$  
   c) $51$  
   d) $54$  
   e) $61$
5) What is the value of $a$ in the picture above?

a) 32  

b) 45  

c) 59  

d) 121  

e) 148

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**THE TRIANGLE INEQUALITY:**

*Given the lengths of 2 sides of a triangle, the 3rd side must be between the difference and the sum of the 2 sides.*

6) A triangle has sides of lengths 5, 8, and $x$. Which of the following could be the value of $x$? Indicate all such values.

☐ a) 2.9  

☐ b) 4.5  

☐ c) 6.25  

☐ d) 7  

☐ e) 13

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7) In the triangle above, $x$ could be any number except:

a) 1  

b) 7  

c) 11  

d) 16  

e) 20
C) TRANSFORMATIONS

1) If triangle JKL in the xy-plane shown above is shifted 7 units to the right and 4 units up, what would be the coordinates of point L after the shift?

a) (-6, -8)  b) (3, -3)  c) (6, 2)  d) (0, 8)  e) (8, 0)

2) Triangle DEF in the xy-plane above will be translated 3 units to the right and then 2 units down. What point will correspond to vertex E after these translations?

a) (2, 1)  b) (1, 2)  c) (-2, 1)  d) (1, -2)  e) (-2, -1)
3) Which of the following graphs shows a 90 degree counterclockwise rotation of the figure above followed by a reflection over the x-axis?

a) ![Graph A]

b) ![Graph B]

c) ![Graph C]

d) ![Graph D]

e) ![Graph E]

4) If the segment RT is reflected across the x-axis to the new coordinates R’T’, which of the following could be the coordinates of R’ and T’?

R’ is read “R prime” and it means the new R.
T’ is read “T prime” and it means the new T.

a) (-2,5)(-9,1)  
b) (-2,-5)(-9,-1)  
c) (2,-5)(9,-1)

d) (5,2)(1,9)  
e) (-2,-5)(9,1)
TYPES OF TRANSFORMATIONS:

A translation is a ________

A reflection is a ________ over a line.

A rotation is a ________ about a point.

A dilation will __________ the size.

A reduction will __________ the size.

5) If \( \overline{AB} \) is mapped to \( \overline{A'B'} \) so that \( AB = A'B' \), which of the following is a possible transformation? Choose all that apply.

- [ ] a) A 180° clock-wise rotation of \( \overline{AB} \) about the origin.
- [ ] b) A dilation of \( \overline{AB} \) of scale 3.
- [ ] c) A reduction of \( \overline{AB} \) of scale 3.
- [ ] d) A translation of \( \overline{AB} \) two units to the right and 7 units down.
- [ ] e) A reflection of \( \overline{AB} \) across the x-axis.
D) CIRCLES

A radius is equal to the distance from the center to any point on the circle. A diameter is the distance across a circle through the center. A radius = \( \frac{1}{2} \) of a diameter. A diameter = \( 2 \times \) radius. There are 360 degrees in a circle.

The distance “around” a circle is the Circumference = (diameter) \( \pi \)

Length of an arc: \( \frac{\text{number of degrees in the arc}}{360} \times d\pi \)

Area of a circle = \( \pi \) (radius)\(^2\)

Area of a sector of a circle: \( \frac{\text{number of degrees in the arc}}{360} \times \pi r^2 \)

radius            diameter                        arc                        sector

1) A large wheel has a diameter of 30 inches, and a small wheel has a diameter of 20 inches. How many revolutions does the small wheel need to make to travel the same distance that the large wheel travels in 240 revolutions?

a) 160       b) 240       c) 320       d) 360       e) 420

Hint: 1 revolution = 1 circumference
LESSON 3 – GEOMETRY

2) If the circumference of a circle is 96 feet, which of the following is closest to the area of the circle?
   a) 610  b) 735  c) 2900  d) 3800  e) 4700

3) Harry wants to make a circle graph. He budgets $150 out of his paycheck of $450 for food. How many degrees should be in the interior angle (also called the “central angle”) for food?
   A) 30  B) 60  C) 90  D) 120  E) 200

Directions: Figure out what fraction of the total is spent on food. Then write a proportion comparing this fraction to _____ degrees in a circle!

4) Dawn wants to put a circular rug onto the floor that is a rectangle with dimensions 12 ft. by 14 ft. What is the area of the largest rug that will fit into the room?
   a) 15π  b) 36π  c) 49π  d) 75π  e) 225π

\[ \text{Area} = \pi \cdot R^2 \]
5) In a circle graph a sector of 100 degrees represents an investment of 25 million dollars. What is the value of the total investment?
   a) 100 million   b) 85 million   c) 75 million
   d) 125 million   e) 90 million

6) In a circle graph a sector of 100 degrees represents the amount a company spent on employee salaries. If the entire budget of the company is 25 million, how much was spent on employee salaries?
   a) 6.94 million   b) 8.72 million   c) 15.48 million
   d) 11.35 million   e) 20.25 million
7) The area of the shaded sector shown is $75\pi$. What is the circumference of the circle?

a) 15  b) $12\pi$  c) 24  d) $24\pi$  e) $30\pi$

Area of a sector =

Circumference =
E) AREA & VOLUME

**FORMULAS FOR AREA**

**RECTANGLE**
- The area of a rectangle = length • width

**SQUARE**
- The area of a square = (length • width) or (side)$^2$

**TRIANGLE**
- The area of a triangle = \( \frac{1}{2} \) base • height

**PARALLELOGRAM**
- The area of a parallelogram = base • height

**RHOMBUS**
- The area of a rhombus = base • height
  - or \( \frac{1}{2} \)(diagonal$_1$ • diagonal$_2$)

**TRAPEZOID**
- The area of a trapezoid = \( \frac{1}{2} \)(base$_1$+base$_2$)height

1) What is the area of the trapezoid shown below?

![Trapezoid Diagram]

- a) 195
- b) 200
- c) 205
- d) 219
- e) 215

2) What is the area of the shaded triangle in the rectangle below?

![Rectangle Diagram]
3) A garden path is made up of six congruent trapezoidal stepping stones as shown above. Each stone has bases of 8 in. and 10 in. and heights of 6 in. Find the total area of the stones.

4) Buddy is getting ready to roll his lawn with the lawn roller shown above. The diameter of the roller is a half of a foot. Approximately how many square feet will the roller cover in two rotations?

a) 4.71  b) 9.42  c) 10.03  d) 10.92  e) 15.5
VOLUME OF A RECTANGULAR SOLID (aka box)
\[ V = L \times W \times H \]

1) An aquarium tank has a volume of 10 cubic feet. If it is 1 foot wide, and 2 feet high, what is its length?

![Aquarium Tank](image)

- a) 4
- b) 5
- c) 18
- d) 30
- e) 32

2) A driveway is 40 feet by 6 feet by 1/18 feet. How much concrete would be needed to fill the driveway?

- a) 4,320 cu. ft.
- b) 1,240 cu. ft.
- c) 20.7 cu. ft.
- d) 13.3 cu. ft.
- e) 9.7 cu. ft.

3) The formula for volume of a pyramid is:
\[ V = \frac{1}{3} Bh \]
where B represents the area of the base and h represents the height.

Find the volume of this square pyramid:

![Pyramid](image)
4) The figure above shows a right circular cone with base radius 8 and height 30. The shaded portion of the figure is a right circular cone with height 15. The volume of the smaller cone is what fraction of the volume of the larger cone? (The volume of a right circular cone with base radius \( r \) and height \( h \) is \( \frac{1}{3}\pi r^2 h \).)

5) The cylinder above has a hole with a 2 inch diameter cut out of the center. What is the volume of the remaining solid? \( V = \pi r^2 h \)

- a) \( 378\pi \)
- b) \( 384\pi \)
- c) \( 390\pi \)
- d) \( 398\pi \)
- e) \( 402\pi \)
6) A right triangular prism is shown above. If the area of the shaded rectangle is 2924, what is the value of x to the nearest tenth?

7) Find the volume of the triangular prism below. The volume of a prism is \( V = Bh \) where B represents the area of the base.
F) CROSS-SECTIONS

1) Which figure would represent a cross-section that is parallel to the base of the pyramid above?
   a) square   b) rhombus   c) circle   d) triangle   e) trapezoid

2) Which figure would represent a cross-section that is parallel to the base of the cylinder above?
   a) ellipse   b) circle   c) rectangle   d) parabola   e) trapezoid

3) Candice cuts out a “slice” of the solid with a plane parallel to the base (B), covers it with ink and then presses it to a piece of paper. Which of the following shows the shape of the ink on the paper?
   a)   
   b)   
   c)   
   d)   
   e)