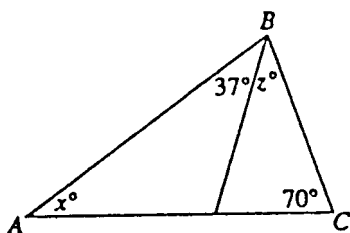
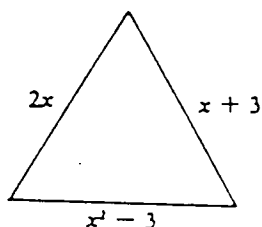


### Category 10 Triangles



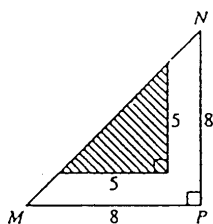
1. In  $\triangle ABC$  above, what is  $x$  in terms of  $z$ ?

(A)  $z + 73$   
 (B)  $z - 73$   
 (C)  $70 - z$   
 (D)  $z - 70$   
 (E)  $73 - z$



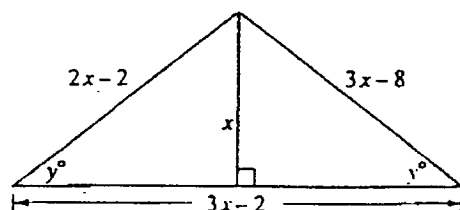
2. For what value of  $x$  will the triangle above be equilateral?

(A) 2  
 (B) 3  
 (C) 6  
 (D) 9  
 (E) 12



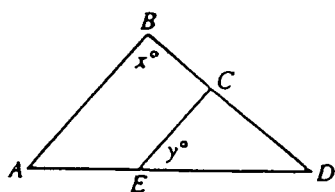
3. In the figure above, the perimeter of  $\triangle MNP$  is how much greater than the perimeter of the shaded region?

(A)  $2 + \sqrt{2}$   
 (B) 6  
 (C)  $8\sqrt{2}$   
 (D)  $6 + 3\sqrt{2}$   
 (E)  $6 + 8\sqrt{2}$



4. The figure above shows the dimensions of an isosceles triangle in terms of  $x$ . What is the area of the triangle?

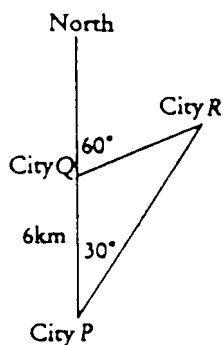
(A) 24  
(B) 30  
(C) 48  
(D) 60  
(E) 96



Note: Figure not drawn to scale.

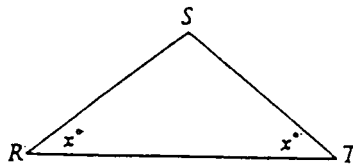
5. In the figure above, if  $AB \parallel CE$ ,  $CE = DE$ , and  $y = 45$ , then  $x =$

(A) 45  
(B) 60  
(C) 67.5  
(D) 112.5  
(E) 135

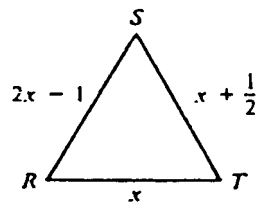


6. On the map above, if the segment that joins cities  $P$  and  $Q$  represents 6 kilometers, how many kilometers does the segment that joins cities  $Q$  and  $R$  represent?

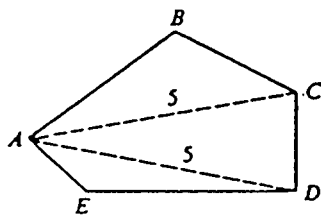
(A)  $3\sqrt{3}$   
(B) 6  
(C) 9  
(D)  $6\sqrt{3}$   
(E) It cannot be determined from the information given



7. If the perimeter of  $\triangle RST$  above is 40, which of the following could NOT be the length of  $RT$  ?
- (A) 21  
(B) 19  
(C) 17  
(D) 15  
(E) 13

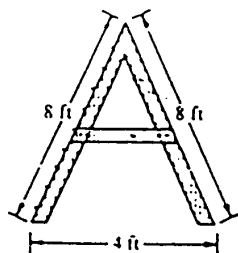


8. In  $\triangle RST$  above, if the measure of  $\angle R$  equals the measure of  $\angle T$ , then  $RT =$
- (A)  $\frac{1}{2}$   
(B) 1  
(C)  $\frac{3}{2}$   
(D) 2  
(E)  $\frac{5}{7}$



**Note :** Figure not drawn to scale.

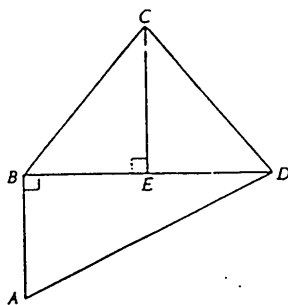
9. In the figure above, if the sum of the perimeters of the three triangles is 37, what is the perimeter of pentagon  $ABCDE$ ?
- (A) 32  
(B) 27  
(C) 25  
(D) 22  
(E) 17



**Note :** Figure not drawn to scale.

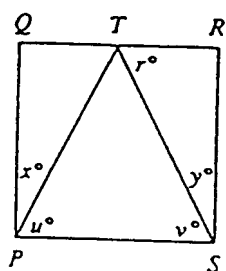
10. The figure above shows the dimensions of a stepladder that stands on a floor. How high is the top of the ladder from the floor?

- (A) 4 ft  
 (B) 5 ft  
 (C) 6 ft  
 (D)  $4\sqrt{3}$  ft  
 (E)  $2\sqrt{15}$  ft



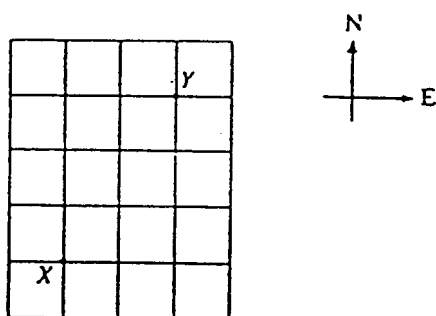
11. In the figure above,  $CE = 5$ ,  $BD = 8$ , and the area of quadrilateral  $ABCD$  is 36. What is the area of  $\triangle ABD$ ?

- (A) 4      (B) 9      (C) 16      (D) 20      (E) 56



12. In the figure above, If  $PQRS$  is a square and  $QT = TR$ , which of the following statements is NOT true?

- (A)  $PT = TS$   
 (B)  $x = y$   
 (C)  $u = v$   
 (D)  $r = y$   
 (E) The area of  $\triangle PQT$  is equal to the area of  $\triangle SRT$ .



**Note :** Figure not drawn to scale.

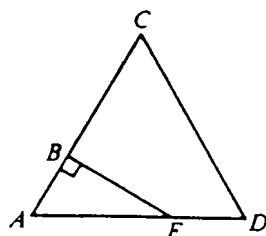
13. In City  $R$ , streets run either east-west or north-south, as shown on the map above. Blocks along east-west streets are 400 feet long and blocks along north-south streets are 200 feet long. If the width of the streets is ignored, what is the straight-line distance, in feet, from  $X$  to  $Y$ ?
- (A)  $200\sqrt{5}$   
(B) 1,000  
(C) 1,200  
(D)  $400\sqrt{10}$   
(E) 1,600

### <High Level Questions>

14. If 3 and 8 are the lengths of two sides of a triangular region, which of the following can be the length of the third side?
- I. 5  
II. 8  
III. 11
- (A) II only  
(B) III only  
(C) I and II only  
(D) II and III only  
(E) I, II, and III
15. The length of each side of a triangle is an even number. If no two of the sides are equal, what is the smallest perimeter the triangle could have?
- (A) 18  
(B) 16  
(C) 14  
(D) 12  
(E) 6

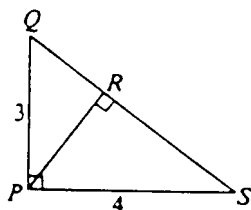
16. The lengths of two sides of a right triangle are  $\frac{d}{3}$  and  $\frac{d}{4}$ . If one of these sides is the hypotenuse, what is the length of the third side of the triangle?

- (A)  $\frac{5d}{12}$   
 (B)  $\frac{d}{\sqrt{7}}$   
 (C)  $\frac{d}{5}$   
 (D)  $\frac{d}{12}$   
 (E)  $\frac{d\sqrt{7}}{12}$



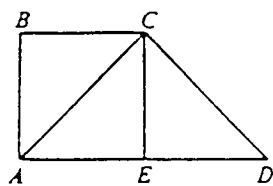
17. If each side of  $\triangle ACD$  above has length 3 and if  $AB$  has length 1, what is the area of region  $BCDE$ ?

- (A)  $\frac{9}{4}$       (B)  $\frac{7}{4}\sqrt{3}$       (C)  $\frac{9}{4}\sqrt{3}$       (D)  $\frac{7}{2}\sqrt{3}$       (E)  $6 + \sqrt{3}$

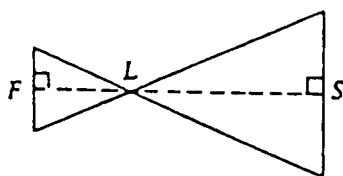


18. In  $\triangle PQS$  above, if  $PQ = 3$  and  $PS = 4$ , then  $PR =$

- (A)  $\frac{9}{4}$   
 (B)  $\frac{12}{5}$   
 (C)  $\frac{16}{5}$   
 (D)  $\frac{15}{4}$   
 (E)  $\frac{20}{3}$

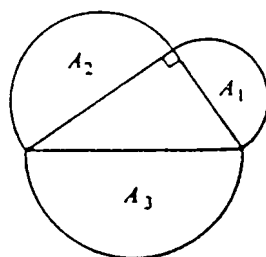


19. In the figure above, square region  $ABCE$  and triangular region  $ACD$  each have area 36. What is the perimeter of triangle  $ACD$  ?
- (A) 24  
 (B)  $12 + 12\sqrt{2}$   
 (C) 36  
 (D)  $18 + 18\sqrt{2}$   
 (E)  $36\sqrt{2}$

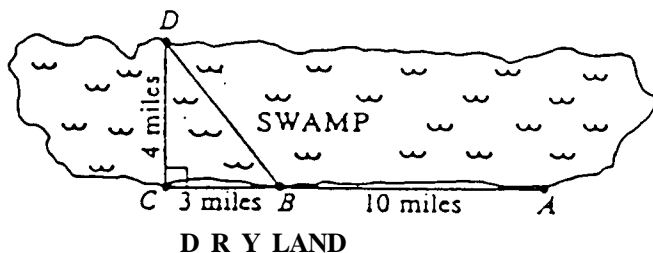


Note : Figure not drawn to scale.

20. The figure above shows the relative positions of a projection lens  $L$ , a film  $F$ , and a screen  $S$ . The film is 6 inches from the lens and is parallel to the screen. How many feet from the screen is the lens if a 0.3-inch figure on  $F$  projects a 6-foot image on  $S$  ? (1 foot = 12 inches)
- (A) 0.3  
 (B) 10  
 (C) 12  
 (D) 100  
 (E) 120



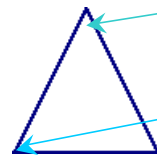
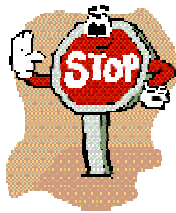
21. In the figure above, if  $A_1$ ,  $A_2$ , and  $A_3$  are the areas of the respective semicircular regions, what is the value of  $\frac{A_1 + A_2}{A_3}$  ?
- (A) 1      (B)  $\frac{3}{2}$       (C)  $\frac{p}{2}$       (D) 2      (E)  $\frac{3p}{2}$



22. A cable is being laid from one side of a swamp, at point  $A$ , to the other side, at point  $D$ . If laying cable costs \$500 per mile on dry land and \$800 per mile in the swamp, how much is saved by laying the cable on the  $ABD$  route rather than the  $ABCD$  route?
- (A) \$700  
(B) \$1,000  
(C) \$1,500  
(D) \$3,200  
(E) \$4,700
23. A ladder that is 13 feet long is placed against a vertical wall so that the top of the ladder is 5 feet below the top of the wall. If the bottom of the ladder rests on level ground and is 5 feet out from the base of the wall, what is the height of the wall, in feet?
- (A) 12  
(B) 13  
(C) 17  
(D) 19  
(E) 23
24. A ladder 25 feet long is leaning against a wall that is perpendicular to level ground. The bottom of the ladder is 7 feet from the base of the wall. If the top of the ladder slips down 4 feet, how many feet will the bottom of the ladder slip?
- (A) 4  
(B) 5  
(C) 8  
(D) 9  
(E) 15



25. A rope hangs from the top of a vertical pole, leaving 4 feet of slack on the floor. When fully extended, the rope touches the floor at a point 12 feet away from the pole. How many tall is the pole?
- (A) 4  
(B) 12  
(C) 13  
(D) 16  
(E) 20



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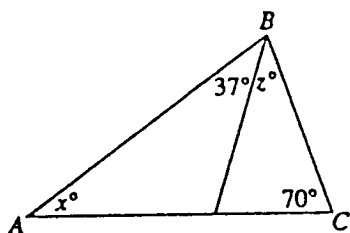
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### Category 10 Triangles



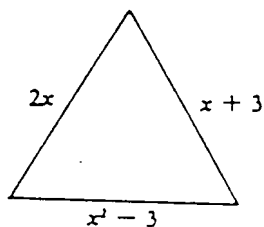
1. In  $\triangle ABC$  above, what is  $x$  in terms of  $z$ ?

- (A)  $z + 73$
- (B)  $z - 73$
- (C)  $70 - z$
- (D)  $z - 70$
- (E)  $73 - z$

$$z + x + 73 - z = 180 \quad \cdot X + 37 + Z + 70 = 180,$$



(E)



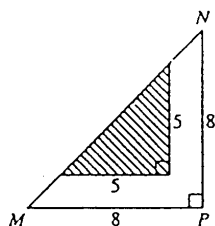
2. For what value of  $x$  will the triangle above be equilateral?

- (A) 2
- (B) 3
- (C) 6
- (D) 9
- (E) 12

$$2x = x + 3, \quad x = 3$$



(B).



3. In the figure above, the perimeter of  $\triangle MNP$  is how much greater than the perimeter of the shaded region?

- (A)  $2 + \sqrt{2}$   
 (B) 6  
 (C)  $8\sqrt{2}$   
 (D)  $6 + 3\sqrt{2}$   
 (E)  $6 + 8\sqrt{2}$

--- 가 a, b, c  $b^2 + c^2 = a^2$  ,

a

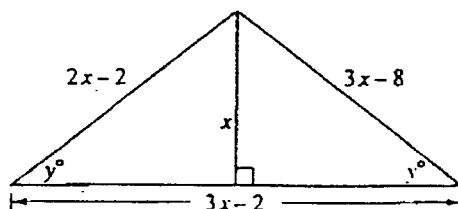
$$8^2 + 8^2 = (8\sqrt{2})^2, \quad 5^2 + 5^2 = (5\sqrt{2})^2$$

$$16 + 8\sqrt{2}, \quad 10 + 5\sqrt{2}$$

$$6 + 3\sqrt{2}$$



(D)



4. The figure above shows the dimensions of an isosceles triangle in terms of  $x$ . What is the area of the triangle?

- (A) 24  
 (B) 30  
 (C) 48  
 (D) 60  
 (E) 96

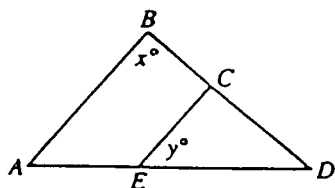
(isosceles)

$2x - 2 = 3x - 8, \quad x = 6. \quad 6 \quad 16$

$$\frac{1}{2}(6 \times 16) = 48$$



(C)



Note: Figure not drawn to scale.

5. In the figure above, if  $AB \parallel CE$ ,  $CE = DE$ , and  $y = 45$ , then  $x =$

- (A) 45  
(B) 60  
(C) 67.5  
(D) 112.5  
(E) 135

$$\begin{array}{l} AB \parallel CE \\ \angle C = \angle D \\ y = 45 \end{array}$$

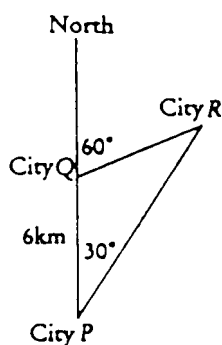
$$\begin{array}{l} \angle B = \angle C \\ \angle D = x \\ 2x + 45 = 180, \end{array}$$

$$\begin{array}{l} \angle C = x \\ x = 67.5 \end{array}$$

$$\begin{array}{l} CE = DE \\ x \end{array}$$



(C)



6. On the map above, if the segment that joins cities  $P$  and  $Q$  represents 6 kilometers, how many kilometers does the segment that joins cities  $Q$  and  $R$  represent?

- (A)  $3\sqrt{3}$   
(B) 6  
(C) 9  
(D)  $6\sqrt{3}$   
(E) It cannot be determined from the information given

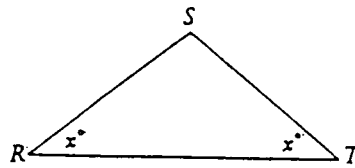
$$\begin{array}{l} \angle P = 30^\circ, \angle Q = 60^\circ \\ (120 + 30) = 30^\circ \end{array}$$

$$\begin{array}{l} \angle QP = 60^\circ \\ \angle QR = 60^\circ \end{array}$$

$$\begin{array}{l} \angle R = 180^\circ - 120^\circ - 30^\circ = 30^\circ \end{array}$$



(B)



7. If the perimeter of  $\triangle RST$  above is 40, which of the following could NOT be the length of  $RT$ ?

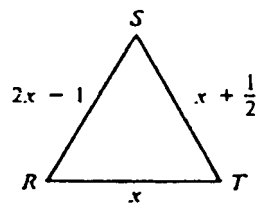
- (A) 21  
(B) 19  
(C) 17  
(D) 15  
(E) 13

---

가 .  
a 가 .  
2a > RT  
40 40 - 21 = 19. 19  
(2a) , 19 > 21(RT) (A)가 .



(A)



8. In  $\triangle RST$  above, if the measure of  $\angle R$  equals the measure of  $\angle T$ , then  $RT =$

- (A)  $\frac{1}{2}$   
(B) 1  
(C)  $\frac{3}{2}$   
(D) 2  
(E)  $\frac{5}{7}$

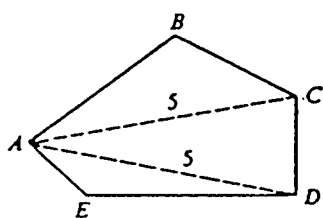
R T

가 .  $2x - 1 = x + 1/2$ 

$$x = 3/2$$



(C)



**Note :** Figure not drawn to scale.

9. In the figure above, if the sum of the perimeters of the three triangles is 37, what is the perimeter of pentagon  $ABCDE$ ?

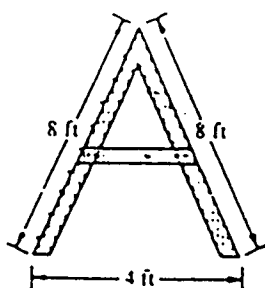
- (A) 32  
(B) 27  
(C) 25  
(D) 22  
(E) 17

$$\begin{aligned} AB=a \quad BC=b \quad CD=c \quad DE=d \quad EA=e \quad & \text{ } \\ (5+d+e) = 37, & \quad a + b + c + d + e = 17 \end{aligned}$$



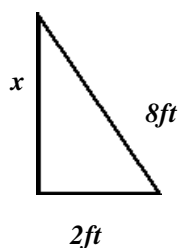
(E)

**Note :** Figure not drawn to scale.



10. The figure above shows the dimensions of a stepladder that stands on a floor. How high is the top of the ladder from the floor?

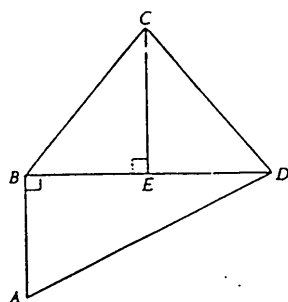
- (A) 4 ft      (B) 5 ft      (C) 6 ft      (D)  $4\sqrt{3}$  ft      (E)  $2\sqrt{15}$  ft



(E)

$x$

$$8^2 - 2^2 = (2\sqrt{15})^2$$



11. In the figure above,  $CE = 5$ ,  $BD = 8$ , and the area of quadrilateral  $ABCD$  is 36. What is the area of  $\triangle ABD$ ?

(A) 4  
(B) 9  
(C) 16  
(D) 20  
(E) 56

BCD ABD

BCD

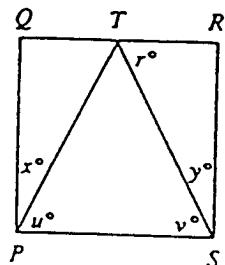
$$20 = \frac{1}{2}(5 \times 8)$$

36 20

16



(C)



12. In the figure above, If  $PQRS$  is a square and  $QT = TR$ , which of the following statements is NOT true?

(A)  $PT = TS$   
(B)  $x = y$   
(C)  $u = v$   
(D)  $r = y$   
(E) The area of  $\triangle PQT$  is equal to the area of  $\triangle SRT$ .

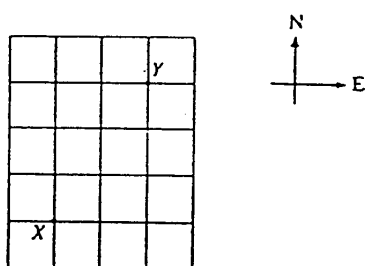
가

4

$$r = y$$



(D)



**Note :** Figure not drawn to scale.

13. In City  $R$ , streets run either east-west or north-south, as shown on the map above. Blocks along east-west streets are 400 feet long and blocks along north-south streets are 200 feet long. If the width of the streets is ignored, what is the straight-line distance, in feet, from  $X$  to  $Y$ ?

- (A)  $200\sqrt{5}$   
 (B) **1,000**  
 (C) 1,200  
 (D)  $400\sqrt{10}$   
 (E) 1,600

400 feet 200 feet  
 block 가 400 feet 200 feet blocks 가  
 . Block  
 x y 가 2 blocks 3 blocks  
 $800^2 + 600^2 = 1000^2$



(B)

### <High Level Questions >

14. If 3 and 8 are the lengths of two sides of a triangular region, which of the following can be the length of the third side?

- I. 5  
 II. 8  
 III. 11  
 (A) **II only**  
 (B) III only  
 (C) I and II only  
 (D) II and III only  
 (E) I, II, and III

가 3, 8 5 (3 8) 11 (3 8)  
 11)



(A)



15. The length of each side of a triangle is an even number. If no two of the sides are equal, what is the smallest perimeter the triangle could have?

(A) 18  
(B) 16  
(C) 14  
(D) 12  
(E) 6

가

4, 6, 8



(A)

16. The lengths of two sides of a right triangle are  $\frac{d}{3}$  and  $\frac{d}{4}$ . If one of these sides is the hypotenuse, what is the length of the third side of the triangle?

(A)  $\frac{5d}{12}$   
(B)  $\frac{d}{\sqrt{7}}$   
(C)  $\frac{d}{5}$   
(D)  $\frac{d}{12}$   
(E)  $\frac{d\sqrt{7}}{12}$

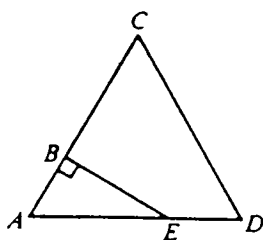
가 가

$\frac{d}{3}$   $\frac{d}{4}$   $\frac{d}{3}$  가

$$\left(\frac{d}{3}\right)^2 = \left(\frac{d}{4}\right)^2 + x^2$$



(E)



17. If each side of  $\triangle ACD$  above has length 3 and if  $AB$  has length 1, what is the area of region  $BCDE$ ?

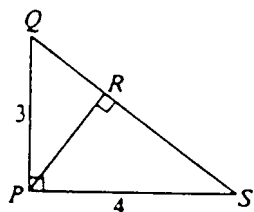
(A)  $\frac{9}{4}$  (B)  $\frac{7\sqrt{3}}{4}$  (C)  $\frac{9}{4}\sqrt{3}$  (D)  $\frac{7}{2}\sqrt{3}$  (E)  $6 + \sqrt{3}$

$\triangle ACD$        $AB$   
 3      3  
 1       $\sqrt{3}$   
 $\triangle ABE$        $BCDE$        $\triangle ACD$

$$\left( \frac{1}{2} \times 3 \times \frac{3\sqrt{3}}{2} \right) - \left( \frac{1}{2} \times 1 \times \sqrt{3} \right) = \frac{7\sqrt{3}}{4}$$

( $\triangle ACD$       )

(B)

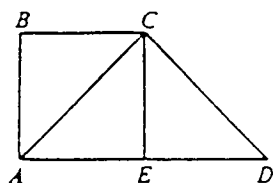


18. In  $\triangle PQS$  above, if  $PQ = 3$  and  $PS = 4$ , then  $PR =$

(A)  $\frac{9}{4}$  (B)  $\frac{12}{5}$  (C)  $\frac{16}{5}$  (D)  $\frac{15}{4}$  (E)  $\frac{20}{3}$

$\triangle PQR$        $\triangle PQS$        $PR$       3:5 = x:4

(B)



19. In the figure above, square region  $ABCE$  and triangular region  $ACD$  each have area 36.

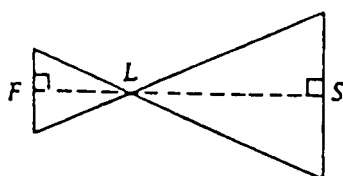
What is the perimeter of triangle  $ACD$ ?

- (A) 24  
 (B)  $12 + 12\sqrt{2}$   
 (C) 36  
 (D)  $18 + 18\sqrt{2}$   
 (E)  $36\sqrt{2}$

$$\begin{aligned} \text{Area of } ABCE &= 36 \\ \text{Area of } ACD &= 36 \\ \text{Let } AC &= x \\ \text{Then } AD &= 6 \end{aligned}$$

$$\frac{1}{2} \times 6 \times x = 36$$

(B)



Note : Figure not drawn to scale.

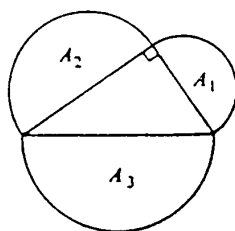
20. The figure above shows the relative positions of a projection lens  $L$ , a film  $F$ , and a screen  $S$ . The film is 6 inches from the lens and is parallel to the screen. How many feet from the screen is the lens if a 0.3-inch figure on  $F$  projects a 6-foot image on  $S$ ? (1 foot = 12 inches)

- (A) 0.3  
 (B) 10  
 (C) 12  
 (D) 100  
 (E) 120

가

$$0.3 : 72 (= 6 \text{ feet} \times 12 \text{ inches}) = 6 : x$$

(E)



21. In the figure above, if  $A_1$ ,  $A_2$ , and  $A_3$  are the areas of the respective semicircular regions,

what is the value of  $\frac{A_1 + A_2}{A_3}$  ?

- (A) ~~1~~      (B)  $\frac{3}{2}$       (C)  $\frac{p}{2}$       (D) 2      (E)  $\frac{3p}{2}$

$$\frac{A_1}{2} \cdot \frac{(a_1)^2 \mathbf{p}}{2}, \frac{A_2}{2} \cdot \frac{(a_2)^2 \mathbf{p}}{2}, \frac{A_3}{2} \cdot \frac{(a_3)^2 \mathbf{p}}{2}.$$

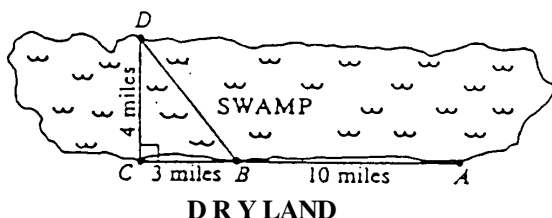
$$a_1, a_2, a_3$$

$$(a_1)^2 + (a_2)^2 = (a_3)^2$$

$$\frac{A_1 + A_2}{A_3} = \frac{(a_1)^2 \mathbf{p}}{2} + \frac{(a_2)^2 \mathbf{p}}{2} \bigg/ \frac{(a_3)^2 \mathbf{p}}{2}$$



(A) 



22. A cable is being laid from one side of a swamp, at point  $A$ , to the other side, at point  $D$ . If laying cable costs \$500 per mile on dry land and \$800 per mile in the swamp, how much is saved by laying the cable on the  $ABD$  route rather than the  $ABCD$  route?

- (A) **\$700**
- (B) **\$1,000**
- (C) **\$1,500**
- (D) **\$3,200**
- (E) **\$4,700**

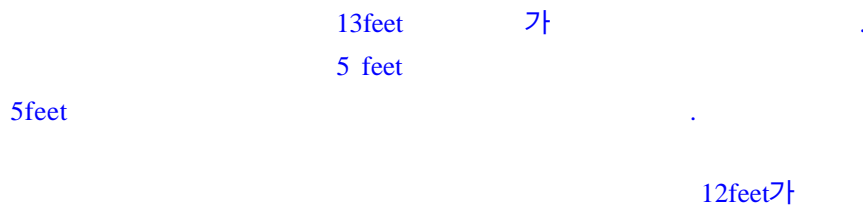
$BD$  가 5 miles  $ABD$   
 가 15 miles  $ABCD$  17miles .10 miles  
 $ABCD$   $ABD$  swamp 1mile dry  
 3miles .



(A) .

23. A ladder that is 13 feet long is placed against a vertical wall so that the top of the ladder is 5 feet below the top of the wall. If the bottom of the ladder rests on level ground and is 5 feet out from the base of the wall, what is the height of the wall, in feet?

(A) 12  
(B) 13  
(C) 17  
(D) 19  
(E) 23



$$(13)^2 - (5)^2 = (12)^2$$

⌂ (C) .

24. A ladder 25 feet long is leaning against a wall that is perpendicular to level ground. The bottom of the ladder is 7 feet from the base of the wall. If the top of the ladder slips down 4 feet, how many feet will the bottom of the ladder slip?

(A) 4  
(B) 5  
(C) 8  
(D) 9  
(E) 15



$$(25)^2 - (7)^2 = (24)^2$$

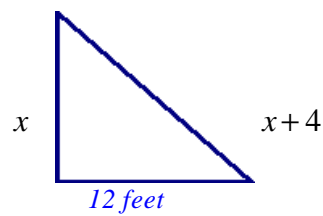
$$(25)^2 - (20)^2 = (15)^2$$

⌂ (C) .

25. A rope hangs from the top of a vertical pole, leaving 4 feet of slack on the floor. When fully extended, the rope touches the floor at a point 12 feet away from the pole. How many tall is the pole?
- (A) 4  
(B) 12  
(C) 13  
(D) 16  
(E) 20

12feet

4feet



$$x^2 + 12^2 = (x + 4)^2 \Rightarrow x = 16$$



(D)