LHF STUDY GUIDE PASS THE HiSET® MATH TEST!
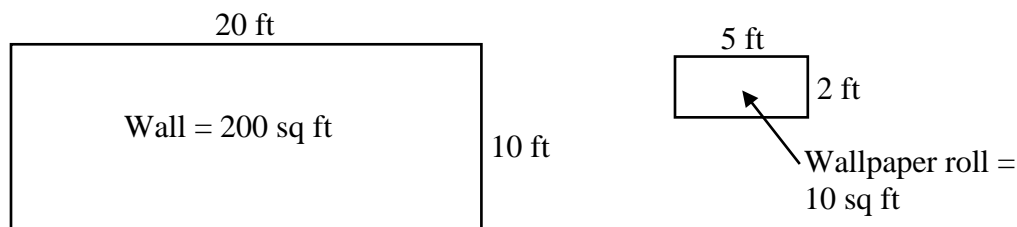
GEOMETRY: Rectangles and Squares
Lesson 2   Area and Perimeter Multi-Step Problems

1. "COVERING AN AREA" WORD PROBLEMS

This type of word problem requires you to figure out how much of some material is needed to cover an area. Answers may be asked for as numbers or expressions.

Example 1 The Logans want to wallpaper one wall in their entryway. The wallpaper comes in rolls that are 2 feet by 5 feet and the wall is 10 feet tall and 20 feet wide. How many rolls of wallpaper will be needed to cover the wall?

A. 200 B. 210 C. 30 D. 20 E. 25

20 ft

Wall = 200 sq ft

10 ft

5 ft

2 ft

Wallpaper roll =
10 sq ft

Step 1: Calculate the area of the wall: 10 x 20 = 200 sq ft
Step 2: Calculate the area that each roll of wallpaper will cover: 2 x 5 = 10 sq ft
Step 3: Divide to see how many rolls are needed: 200 ÷ 10 = 20 rolls of wallpaper
Answer: D. 20

OR
Once you figure out how many square feet need to be covered, and how many square feet are in 1 roll of wallpaper, if you don't know what to do next, you could use trial and error to see how many 10 sq ft rolls are needed to cover the 200 sq ft wall.

Try A. 200 rolls   Does 200 rolls x 10 sq ft per roll = 200 sq ft?
                                No, it is 2,000 sq ft so 200 rolls of wallpaper is not correct.

Try B. 210 rolls   Does 210 rolls x 10 sq ft per roll = 200 sq ft?
                                No, it is 2,100 sq ft so 210 rolls of wallpaper is not correct.

Try C. 30 rolls   Does 30 rolls x 10 sq ft per roll = 200 sq ft?
                                No, it is 300 sq ft so 30 rolls of wallpaper is not correct.

Try D. 20 rolls   Does 20 rolls x 10 sq ft per roll = 200 sq ft?
                                Yes, it is 200 sq ft so 20 rolls of wallpaper is the answer.

Example 2 The Smiths are putting new tile on the floor in their den. Each tile is 1 square foot and is purchased in boxes that contain 16 tiles. How many boxes of tiles will be needed if the den is 13 feet wide and 25 feet long?

A. 20   B. 31   C. 21   D. 8   E. 22

Calculate the number of square feet to be covered: 13 x 25 = 325 sq ft
Square feet of tile per box: 16 tiles x 1 sq ft each = 16 sq ft
Divide to see how many boxes are needed: 325 ÷ 16 = 20.3125 boxes

Normally, 20.3125 would round down to 20.
In this problem you have to go up to 21 boxes because 20 boxes of tile would not be enough to do the job.
Answer: C. 21

Example 3 Alana is adding decorative mirror tile to accent her bathroom wall. If the tiles are 3-inch-square, and she is covering an area that is 6 inches by 75 inches, how many mirror tiles will she need?
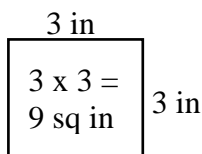
A. 150   B. 75   C. 100   D. 38   E. 50

Note that the tiles are described as 3-inch-square. This means they are square tiles that are 3 inches on each side. Each tile has an area of 3 x 3 = 9 sq in.

"3-inch-square" is not the same as "3 square inches."
"3-inch-square" gives the length of the sides of a square.
"3 square inches" is the area of a figure.

3 in

3 x 3 = 9 sq in	3 in

3-inch-square means a square that is 3 inches on all sides, so area = 3 x 3 = 9 square inches.
3-inch-square **does not** mean 3 square inches.

You need to divide total square inches to be covered by the number of square inches in each tile.
Total square inches to be covered, or area: 6 x 75 = 450 sq in
The number of square inches in each tile: 3 x 3 = 9 sq in
450 ÷ 9 = 50 tiles
Answer: E. 50

Example 4 A porch floor is being covered with outdoor carpet tiles that are each 3 feet long and 1 foot wide, and the porch is 15 feet by 20 feet. Which expression shows how many carpet tiles are needed?

A. (20 x 15) ÷ 3   B. (20 + 15) ÷ 3   C. 20 x 15 x 3
D. 20 + 15 ÷ 3   E. (20 + 15) x 3

Notice that you need an expression answer, not a numerical solution.
You need to divide total square feet to be covered by the number of square feet in each outdoor carpet tile.

Total square feet to be covered, or area: 20 x 15
The number of square feet in each tile: 3 x 1 = 3
Answer: A. (20 x 15) ÷ 3

NOTE – The answer could also have been written as (15 x 20) ÷ 3, and, if you think of the fraction bar as a division sign, it could also be written as

$$\frac{20 \times 15}{3} \quad \text{or} \quad \frac{15 \times 20}{3}.$$

Practice One   *Answers – p. 20*

1. A hotel is putting new wooden flooring down in one of their function rooms. If the room is 60 feet long and 100 feet wide, and the wooden flooring comes in pieces that are 2 feet wide and 10 feet long, how many pieces of wooden flooring will be needed?

A. 300   B. 500   C. 350   D. 12   E. 8

2. A kitchen is getting a new tile floor. The kitchen is 10 feet wide and 24 feet long, and the tiles are 2 feet by 3 feet. Which expression shows how many tiles are needed to cover the kitchen floor?

A. $\frac{6}{10 \times 24}$ B. (10 x 24) + (2 x 3)   C. $\frac{10 \times 24}{6}$

D. 10 x 24 x 6   E. 10 + 24 + 2 + 3

3. Deandra is covering one wall of her craft room with cork tiles. If the wall is 10 feet by 20 feet, and the tiles are 2 feet long and 1 foot wide, which expression represents the number of cork tiles needed?

A. 10 x 20 x 2   B. (10 + 20) x 2   C. (10 + 20) ÷ 2

D. 10 + 20 ÷ 2   E. (10 x 20) ÷ 2

4. How many 4-inch-square tiles are needed to cover a kitchen backsplash area that is 4 feet by 5 feet?

A. 5   B. 720   C. 360   D. 180   E. 810

5. Suzanne is putting new wallpaper on both walls of her entryway. Each wall is 10 feet tall and 30 feet wide, and the wallpaper comes in rolls that are 3 feet wide and 10 feet tall. How many rolls of wallpaper will she need to cover both walls?

A. 10   B. 20   C. 30   D. 40   E. 50

6. Decorative mosaic tile wall covering comes in rolls that each cover 4 square feet. Which expression shows how many rolls will be needed to cover a 10 x 8 foot section of wall?

A. $\dfrac{10 \times 8}{4}$ B. $\dfrac{4}{10 \times 8}$ C. 4 x 8 x 10

D. $\dfrac{4 \times 10}{8}$ E. 10 x 8 + 4

7. Pegboard is sold in 2-foot-square pieces that cost $4.49 each. How much will it cost to cover a section of workshop wall that is 4 feet tall and 8 feet wide?

A. $71.84   B. $143.68   C. $53.92   D. $35.92   E. $8

8. A contractor needs to order enough drywall to cover 520 square feet of wall. How many 4 x 8 foot sheets of drywall should be ordered?
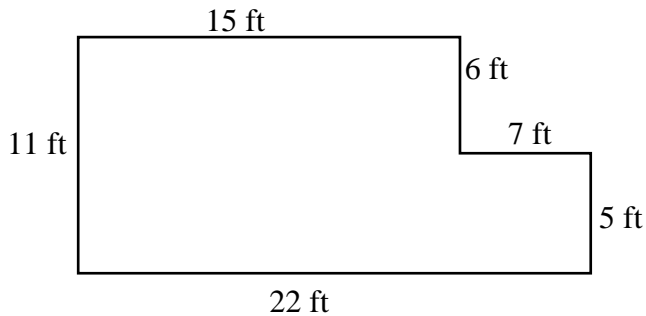
A. 16   B. 17   C. 43   D. 44   E. 71
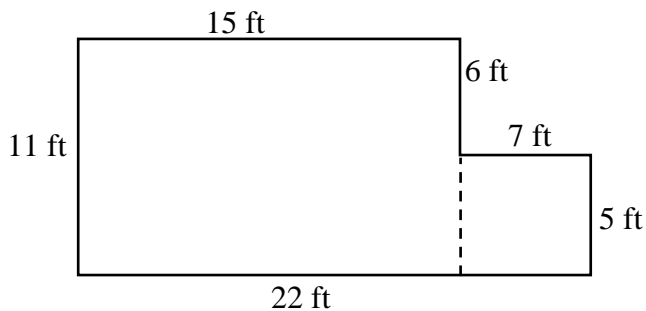
2. AREA OF L-SHAPED FIGURES

In this type of problem, you must divide an L-shaped figure into two rectangles, get the area of each, and then add together to get the total area of the L-shaped figure.

Example 1 What is the area of the figure shown?
A. 165 sq ft   B. 242 sq ft   C. 200 sq ft   D. 250 sq ft   E. 66 sq ft

```
        15 ft
 ┌──────────────┐
 │              │ 6 ft
11 ft           │ 7 ft
 │              └──────┐
 │                     │ 5 ft
 └─────────────────────┘
        22 ft
```

Divide the figure into two rectangles, get the area of each rectangle, and add together.

```
        15 ft
 ┌──────────────┐
 │              │ 6 ft
11 ft           │ 7 ft
 │              ┊──────┐
 │              ┊      │ 5 ft
 └─────────────────────┘
        22 ft
```

Area of small rectangle:
5 x 7 = 35 sq ft

Area of big rectangle:
15 x 11 = 165 sq ft

Total area: 35 + 165 = 200 sq ft

Answer: C. 200 sq ft

Notice that to get the area of the large rectangle on the left side, you multiply 11 x 15, **NOT 11 x 22**. The 22 ft number is the distance all the way across the base of both rectangles. This is longer than the base of the one rectangle that you are measuring.

You could also divide into two rectangles the other way, and get the same answer.

```
        15 ft
 ┌──────────────┐
 │              │ 6 ft
11 ft           │ 7 ft
 ┊──────────────┊──────┐
 │                     │ 5 ft
 └─────────────────────┘
        22 ft
```

Area of top rectangle:
15 x 6 = 90 sq ft

Area of bottom rectangle:
5 x 22 = 110 sq ft

Total area: 90 + 110 = 200 sq ft

Answer: C. 200 sq ft

Example 2 What is the area of the bedroom bathroom suite shown in the diagram?
A. 500 sq ft   B. 280 sq ft   C. 710 sq ft
D. 210 sq ft   E. 114 sq ft

Get the area of the bedroom and the area of the bathroom and add together.
Notice that in this diagram, the lengths of the sides are shown by arrows pointing to the beginning and end of the side, with the number of feet in the middle of the arrows.

Bedroom area: 20 x 25 = 500 sq ft
Bathroom area: 15 x 14 = 210 sq ft
Add together: 500 + 210 = 710 sq ft   **Answer: C. 710 sq ft**.

Practice Two   *Answers – p. 23*

1. What is the area of the diagram below?
A. 38 sq ft   B. 58 sq ft   C. 50 sq ft   D. 68 sq ft   E. 24 sq ft

2. What is the area of the figure below?

A. 500 sq in   B. 800 sq in   C. 425 sq in   D. 300 sq in   E. 95 sq in

40 in

5 in

25 in

20 in

15 in

15 in

3. What is the area of the corner of an office suite that holds the conference room and break room as shown in the diagram?

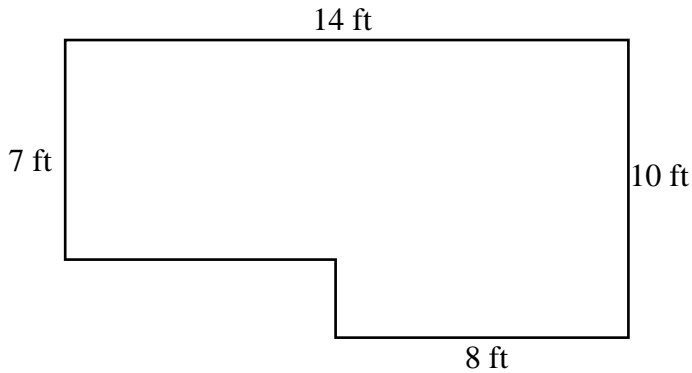A. 780 sq ft   B. 540 sq ft   C. 1,125 sq ft   D. 660 sq ft   E. 390 sq ft

30 ft

18 ft   Conference Room

8 ft   Break Room

15 ft

3. MISSING INFORMATION IN L-SHAPED FIGURES

In this type of problem, the lengths of some sides are not provided. Use the lengths that are provided to calculate the missing lengths, then calculate what is asked for in the problem.

Example 1 What is the distance around the edge of the figure shown in the diagram?
A. 39 ft   B. 48 ft   C. 42 ft   D. 45 ft   E. 47 ft

14 ft

7 ft   10 ft

8 ft

Notice that two of the sides have not been labeled with the length. Before you can get perimeter, you have to calculate these two lengths.

14 ft

7 ft   10 ft

6 ft   3 ft

8 ft

Side A
14 − 8 = 6

Side B
10 − 7 = 3

When you are calculating the missing length of a side, look at the sides that go in the same direction as the side with the missing length. Then, add or subtract the numbers.

Missing Side A is horizontal, (goes across), so look at the lengths of the other horizontal sides, which are 14 and 8.   14 − 8 = 6 ft

Missing Side B is vertical, (goes up and down) so look at the lengths of the other vertical sides, which are 10 and 7.   10 − 7 = 3 ft
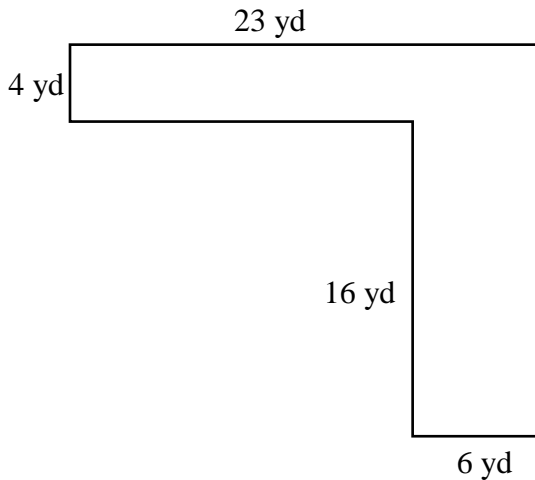
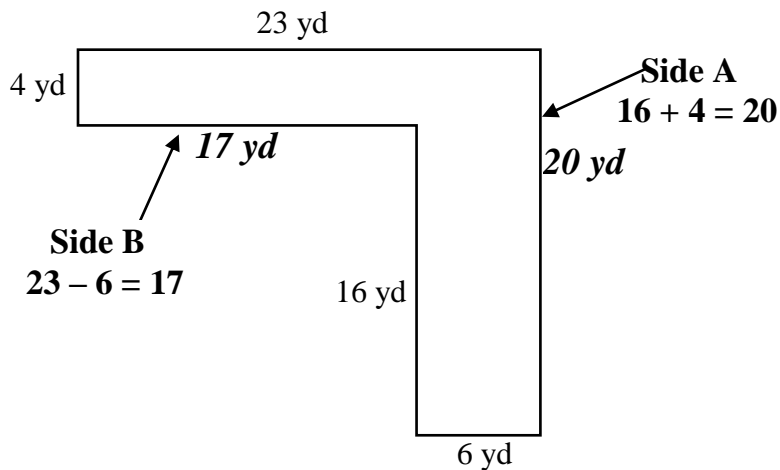Add up the sides to get perimeter: 7 + 14 + 10 + 8 + 3 + 6 = 48
Answer: B. 48 ft

TIP – Be careful that you add up all 6 sides. Don't leave one out by mistake.

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Example 2 How long will a railing be if it goes all the way around the edge of the exhibit space shown in the diagram?

A. 49 yd   B. 69 yd   C. 66 yd   D. 86 yd   E. 96 yd

```
        23 yd
  ┌───────────────┐
4 yd│               │
  └───────┐       │
          │       │
          │ 16 yd │
          │       │
          │       │
          └───────┘
            6 yd
```

Calculate the two missing lengths, then add up the sides.

```
        23 yd
  ┌───────────────┐        Side A
4 yd│               │←      16 + 4 = 20
  └───────┐  ↗17 yd │
          │  20 yd
  Side B  │       │
  23 – 6 = 17  16 yd│
          │       │
          └───────┘
            6 yd
```

Side A
16 + 4 = 20
20 yd

17 yd

Side B
23 – 6 = 17

For Side A, look at the lengths of the other two sides that go in the same direction. These are the sides that measure 16 yd and 4 yd.
Side A is longer than either of those sides, so add to get the length. 16 + 4 = 20 yd

For Side B, look at the lengths of the other two sides that go in the same direction. These are the sides that measure 23 yd and 6 yd.
Side B is shorter than the 23 yd side, so subtract to get the length. 23 – 6 = 17 yd

Perimeter:
4 + 23 + 20 + 6 + 16 + 17 = 86 yd
Answer: D. 86 yd

Example 3 How much will it cost to carpet the exhibit floor in Example 2 if carpet costs $9 per sq yd?

A. $188   B. $1,926   C. $1,080   D. $774   E. $1,692

You already know the missing sides, so calculate area, then multiply to get cost.

23 yd

4 yd

17 yd

Side A
16 + 4 = 20

20 yd

Side B
23 − 6 = 17

16 yd

6 yd

Area of top rectangle: 4 x 17 = 68 sq yd
Area of rectangle on the right: 6 x 20 = 120 sq yd
Total area: 68 + 120 = 188 sq yd
Cost: 188 x $9 = $1,692   **Answer: E. $1,692**

Practice Three   *Answers – p. 25*

1. What is the perimeter of the figure shown below?

A. 118 ft   B. 220 ft   C. 212 ft   D. 110 ft   E. 400 ft

50 ft

32 ft

28 ft

8 ft

2. How long will a fence need to be to surround the playground shown below?
A. 125 yd   B. 140 yd   C. 115 yd   D. 150 yd   E. 110 yd

25 yd

35 yd

25 yd

40 yd

3. Lina needs 12 pieces of fabric shaped like the diagram below for the quilt she is making. How many square inches will these pieces cover?
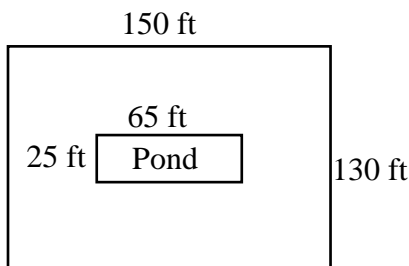A. 27 sq in   B. 216 sq in   C. 28 sq in   D. 336 sq in   E. 324 sq in

8 in

3 in

6 in

1 in

4. AREA OF FIGURES WITH CUTOUTS

In this type of problem, calculate the area of a portion of a rectangle by subtracting out the parts you don't want.

Example 1 A park with a rectangular pond in the center, as shown in the diagram below, is to be planted with new grass. What is the area that will be planted?
A. 19,500 sq ft   B. 190 sq ft   C. 21,125 sq ft
D. 17,875 sq ft   E. 19,410 sq ft

150 ft

65 ft

25 ft   Pond

130 ft

The area to be planted is the space all around the pond, but not including the pond.
Area of the park including the pond: 130 x 150 = 19,500 sq ft
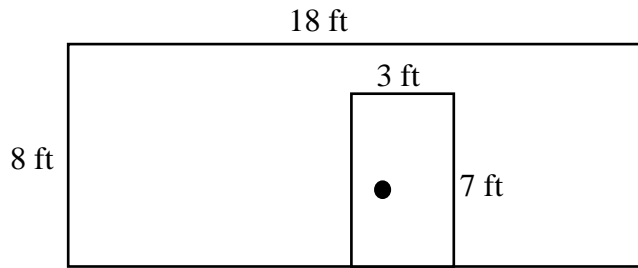Area of the pond: 25 x 65 = 1,625 sq ft
Subtract to get area around the pond: 19,500 – 1,625 = 17,875 sq ft
Answer: D. 17,875 sq ft

Example 2 Which expression shows how many square feet of wallpaper will be needed to cover the wall shown in the diagram?

A. 8 x 18   B. (8 x 18) + (3 x 7)   C. (8 x 18) ÷ (3 x 7)
D. (18 x 7) – (3 x 8)   E. (8 x 18) – (3 x 7)

18 ft, 3 ft, 8 ft, 7 ft

Notice that you need an expression answer, not a number.
Also, understand that the door in the diagram will not be covered with the wallpaper. Sometimes the problem will spell this out and sometimes it won't.

Total area of the wall with door included: 8 x 18
Area of the door by itself: 3 x 7
Subtract door from total area: (8 x 18) – (3 x 7)   **Answer: E. (8 x 18) – (3 x 7)**

Example 3 If wallpaper costs $1.79 per square foot, how much will it cost to buy the wallpaper needed for the wall in Example #2?

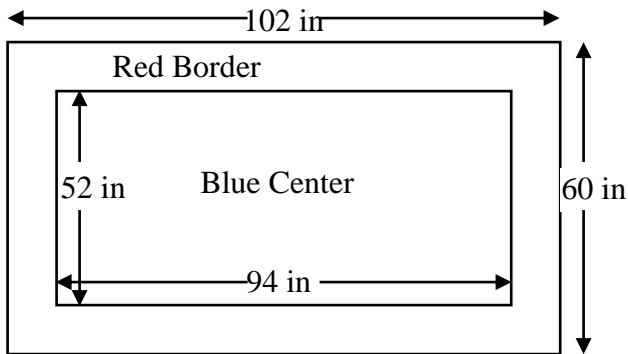A. $257.76   B. $440.34   C. $220.17   D. $202.71   E. $93.08

Total sq ft: (8 x 18) – (3 x 7) = 123 sq ft
Cost: 123 x $1.79 = $220.17
Answer: C. $220.17

Example 4 A blue tablecloth has a red border around the edge. Based on the diagram below, what expression would you use to calculate the area of the red border?

A. 60 x 102   B. (60 x 102) – (52 x 94)   C. (52 x 102) – (60 x 94)
D. (60 x 102) x (52 x 94)   E. (52 x 102) + (60 x 94)

To get the area of the border, you have to get the area of the whole tablecloth (red border plus blue center), and then subtract out the area of the center.

Be careful when reading the numbers on diagrams like this. The many lines and arrows can be confusing. The outside dimensions, for the whole tablecloth, are 60 in and 102 in. The inside dimensions, for the center of the tablecloth, are 52 in and 94 in.

Area of the whole tablecloth: 60 x 102
Area of the center of the tablecloth: 52 x 94
Subtract to get the area of the border: (60 x 102) – (52 x 94)
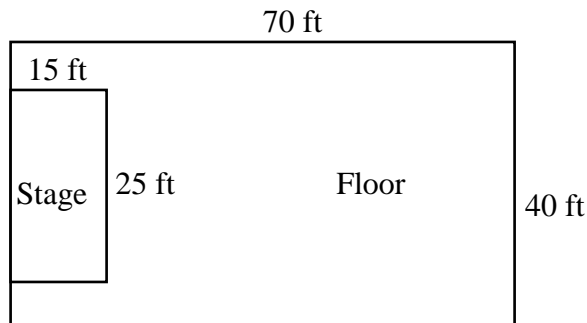**Answer: B. (60 x 102) – (52 x 94)**

NOTE – When a problem asks about the border of something, it is usually a perimeter problem. For example, "How many inches of lace are needed to trim the border of a tablecloth?" is a perimeter question.
The question in Example 4 is not asking for the distance around the edge of the red border, which would be perimeter. It asks for the area of the red border.

Practice Four   *Answers – p. 26*

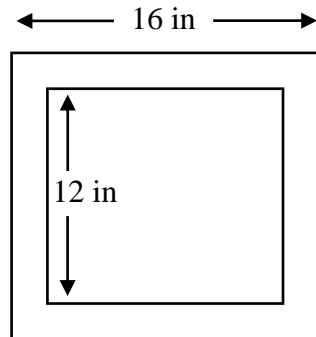**1.** The auditorium below is getting a new wooden floor, except for the stage area which will have a painted floor. What is the area that will be covered with wooden flooring?

A. 2,425 sq ft   B. 2,800 sq ft   C. 300 sq ft   D. 180 sq ft   E. 3,175 sq ft

2. A plain square wooden frame surrounding a square wall mirror is being decorated with mosaic tile. Based on the diagram below, what expression could you use to calculate the square inches of frame area that will be covered with mosaic tile?

A. (16 x 16) + (12 x 12)   B. (16 x 16) – (12 x 12)   C. 2(16 x 12)
D. (12 x 12) – (16 x 16)   E. (16 – 12) x (16 – 12)
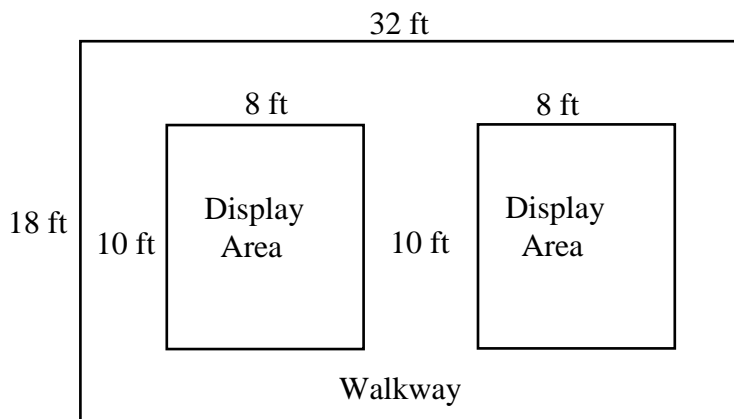

←——— 16 in ———→

12 in

3. A wall with two windows is getting painted with an accent color. The wall measures 10 x 18 feet, and each window is 3 x 4 feet. Which expression would you use to calculate the area of the wall that will be painted?

A. (10 x 18) – (3 x 4)   B. (10 x 18) + (3 x 4)   C. (10 x 18) – 2(3 x 4)
D. (10 x 18) x 2(3 x 4)   E. 2(10 + 18) – 4(3 + 4)

A diagram is not provided, but it may be helpful to draw one.

4. A 32 by18 foot sculpture garden at a museum has a walkway built around and through two display areas, as shown below. To complete the project, the walkway will be tiled with tiles that cost $4 per square foot, and a guardrail that costs $12 per foot will be built around each 8 ft x 10 ft display area. How much will it cost to complete the project?

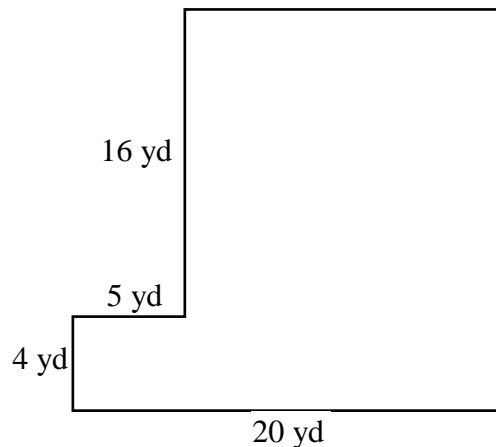A. $1,664   B. $3,584   C. $2,624   D. $2,096   E. $2,528

32 ft

8 ft   8 ft

18 ft

10 ft   Display Area   10 ft   Display Area

Walkway

5. MIXED AREA & PERIMETER PRACTICE

Questions 1 and 2 refer to the diagram below.

1. The area in the diagram will be paved with outdoor tile, and a border of stepping stones will be placed around the outside edge. How many square yards of outdoor tile will be needed?

A. 400 sq yd   B. 80 sq yd   C. 300 sq yd   D. 325 sq yd   E. 320 sq yd

```
          ┌──────────┐
          │          │
  16 yd   │          │
          │          │
          │          │
   5 yd ──┤          │
        │            │
  4 yd  │            │
        └────────────┘
            20 yd
```

2. How long will the stepping stone border be?
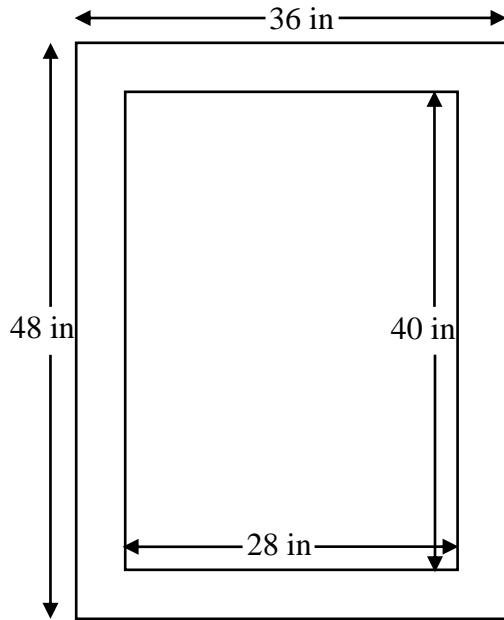
A. 80 yd   B. 60 yd   C. 85 yd   D. 45 yd   E. 65 yd

3. A micro-tile backsplash material is sold in 4 x 1 foot sections, and Adel wants to use it on her backsplash area that measures 3 x 8 feet. Which expression shows how many micro-tile sections are needed?

A. $\frac{4}{3 \times 8}$ B. (3 x 8) x 4   C. $\frac{3 \times 8}{4}$ D. $2(3 + 8) + 2(4 + 1)$ E. $3 \times 4 \div 8$
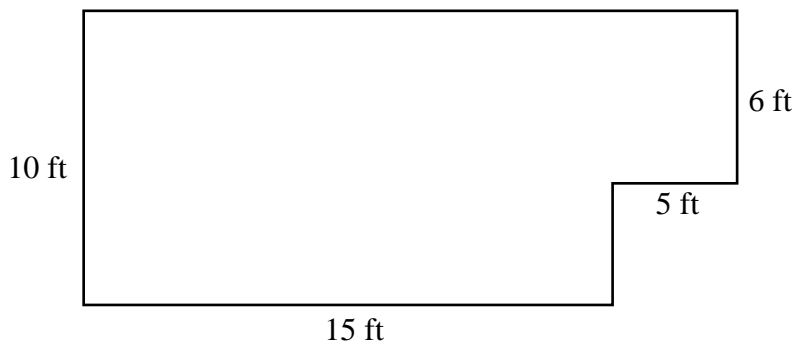
4. Lenore is making posters to advertise a New Year's Eve party, as shown in the diagram below. Each poster will have a border made from fancy metallic fireworks pattern paper. Which expression could you use to calculate the number of square inches of fireworks pattern paper that Lenore will need for each poster?

A. $(48 \times 36) + (28 \times 40)$ B. $(48 \times 36) - (28 \times 40)$ C. $(48 \times 28) - (40 \times 36)$
D. $(48 \times 28) \times (40 \times 36)$ E. $2(48 + 36) + 2(28 \times 40)$

5. How much will it cost to carpet the room shown in the diagram below if carpeting costs $3.99 per square foot?
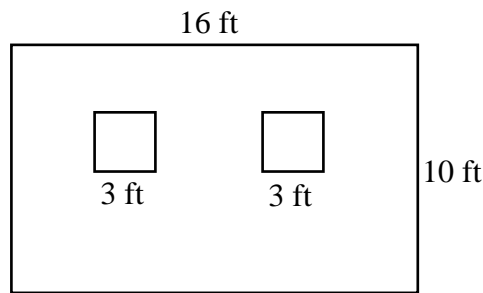
A. $180   B. $143.64   C. $430.92   D. $718.20   E. $798

6. How many 2-foot-square ceiling tiles will be needed to cover the ceiling in a room that is 16 feet long and 20 feet wide?

A. 160   B. 144   C. 36   D. 320   E. 80

Questions 7 – 9 refer to the diagram below of a wall with 2 square windows.

16 ft

3 ft   3 ft

10 ft

7. The wall in the diagram will be painted, not including the 2 square windows. Which expression shows how many square feet of wall will be painted?
A. $(16 \times 10) - (3 \times 3)$ B. $(16 \times 10) - 2(3 \times 3)$ C. $2(16 \times 10) - (3 + 3)$
D. $2(16 \times 10) - 2(3 \times 3)$ E. $(16 \times 10) \div 2(3 \times 3)$

8. In the Gateway Apartment Complex, there are 26 walls exactly like the wall in the diagram that need to be painted. If one gallon of paint covers 400 square feet of wall, how many gallons of paint will need to be purchased to cover the 26 walls?
A. 9   B. 10   C. 15   D. 8   E. 12

9. They are also putting new glass in all the windows in the 26 walls. If glass costs $5 per square foot, what will it cost to buy the glass for all the windows?
A. $468   B. $1,170   C. $1,560   D. $2,340   E. $4,160

10. Decorative tiles for a kitchen backsplash measure 2 inches wide and 2 inches long. How many of these tiles will be needed to cover a backsplash area that is 2 ½ feet by 8 feet?
A. 10   B. 720   C. 5   D. 1,440   E. 270

11. A 12 by 24 inch decorative wall quilt is being put together with pre-cut quilt pieces that are each 4 inches long and 1 inch wide. Which expression shows how many quilt pieces will be needed?
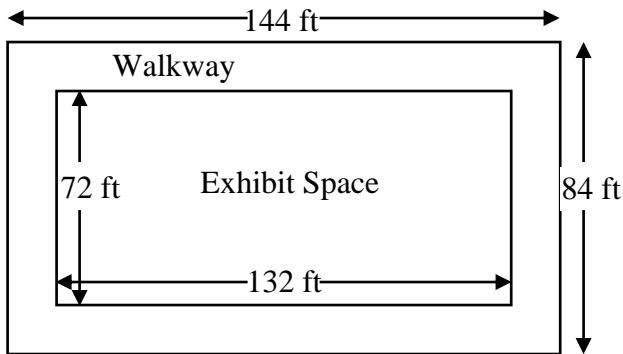A. $(12 \times 24) \times 4$ B. $2(12 + 24) \div 4$ C. $(12 \times 24) \div 4$
D. $2(12 + 24) \times 4$ E. $(12 \times 24) + 4$

12. For the quilt being made in problem #11, the quilt pieces come in packs of 10 that cost $2.75 per pack. How much will it cost to buy enough quilt pieces?
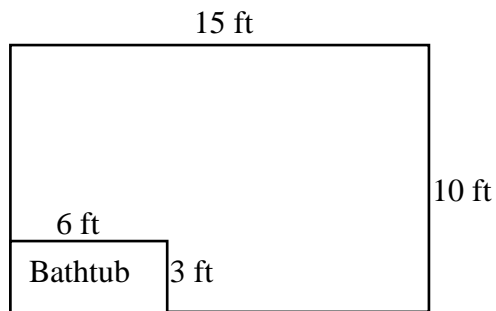A. $72   B. $19.25   C. $27.50   D. $198   E. $22

13. At the zoo, there is a rectangular wild bird exhibit space with a walkway going around all four sides, as shown in the diagram below. What expression would you use to calculate the area of the walkway?

A. 84 x 144 B. (84 x 144) – (72 x 132) C. 72 x 132
D. (84 x 144) + (72 x 132) E. (72 x 144) – (84 x 132)

14. The bathroom shown is getting a new tile floor. Which expression could be used to show how many square feet of tile are needed, assuming that the area under the bathtub will not be tiled?

A. (15 x 10) – (3 x 6) B. (15 x 10) + (3 x 6) C. (15 x 10) x (3 x 6)
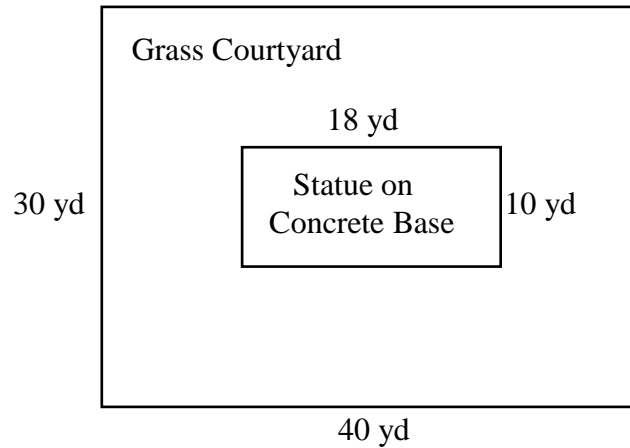D. (15 x 10) ÷ (3 x 6) E. (15 x 6) – (3 x 10)

15. Acoustical ceiling tile is being installed in a workroom that is 72 feet long and 44 feet wide. If each tile covers 8 square feet, which of the following expressions would you use to calculate the number of tiles needed?

A. 72 x 44 x 8 B. 2(72 + 44) ÷ 8 C. 72 ÷ 8 + 44 ÷ 8
D. 2(72 + 44) x 8 E. (72 x 44) ÷ 8

16. The grass courtyard at Boone Town Hall has a statue on a concrete rectangular base as shown in the diagram. If the grass part of the courtyard is being reseeded at a cost of $1.75 per square yard, how much will the reseeding job cost?
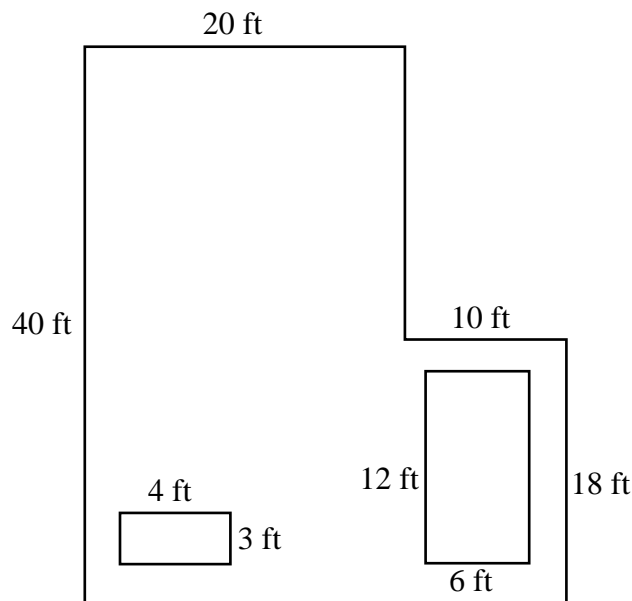
A. $1,785   B. $1,200   C. $1,020   D. $686   E. $1,875

Grass Courtyard

18 yd

Statue on
Concrete Base

10 yd

30 yd

40 yd

*** → Multi-Step Challenger ← ***   *Answer – p. 36*

The layout of Primo Coffee Corner is shown below. There is a 12 by 6 foot counter/coffee station and a 3 by 4 foot condiment station. New wood flooring is being installed everywhere except under these two stations. How much will it cost to install the flooring if the charge is $8 per square foot?

A. $5,728   B. $8,928   C. $7,618   D. $7,168   E. $1,120

20 ft

40 ft

10 ft

4 ft

3 ft

12 ft

18 ft

6 ft

ANSWER KEY   Lesson 2 Area & Perimeter Multi-Step Problems

Practice One

1. A hotel is putting new wooden flooring down in one of their function rooms. If the room is 60 feet long and 100 feet wide, and the wooden flooring comes in pieces that are 2 feet wide and 10 feet long, how many pieces of wooden flooring will be needed?
A. 300   B. 500   C. 350   D. 12   E. 8

You need to calculate the total square feet to be covered with wooden flooring, the number of square feet in each piece of flooring, and then divide.

Square feet to be covered: 60 x 100 = 6,000 sq ft
Square feet in each piece of flooring: 2 x 10 = 20 sq ft
6,000 ÷ 20 = 300 pieces of wooden flooring. **Answer: A. 300**

2. A kitchen is getting a new tile floor. The kitchen is 10 feet wide and 24 feet long, and the tiles are 2 feet by 3 feet. Which expression shows how many tiles are needed to cover the kitchen floor?

A. $\dfrac{6}{10 \times 24}$ B. $(10 \times 24) + (2 \times 3)$ C. $\dfrac{10 \times 24}{6}$

D. 10 x 24 x 6   E. 10 + 24 + 2 + 3

You need to calculate the total square feet to be covered with tile, the number of square feet in each piece of tile, and then divide.
Note that you need an expression, not a numerical solution.

Square feet to be covered: 10 x 24
Square feet in each piece of tile: 2 x 3
Divide to get number of tiles needed: (10 x 24) ÷ (2 x 3)

None of the answer choices looks like this. Some are in fraction form, and some use the number 6 instead of the expression (2 x 3).

(10 x 24) ÷ (2 x 3)   becomes   (10 x 24) ÷ 6.

(10 x 24) ÷ 6 can also be written as $\dfrac{10 \times 24}{6}$ or $\dfrac{24 \times 10}{6}$.

Answer: C. $\dfrac{10 \times 24}{6}$

3. Deandra is covering one wall of her craft room with cork tiles. If the wall is 10 feet by 20 feet, and the tiles are 2 feet long and 1 foot wide, which expression represents the number of cork tiles needed?

A. 10 x 20 x 2   B. (10 + 20) x 2   C. (10 + 20) ÷ 2

D. 10 + 20 ÷ 2   **E. (10 x 20) ÷ 2**

You need to calculate the total square feet to be covered with cork, the number of square feet in each piece of cork, and then divide.
Note that you need an expression, not a numerical solution.

Square feet to be covered: 10 x 20
Square feet in each piece of cork: 2 x 1 = 2
Divide to get number of cork tiles needed: (10 x 20) ÷ 2
Answer: E. (10 x 20) ÷ 2

4. How many 4-inch-square tiles are needed to cover a kitchen backsplash area that is 4 feet by 5 feet?

A. 5   B. 720   C. 360   **D. 180**   E. 810

You need to calculate the total square inches to be covered with tile, the number of square inches in each piece of tile, and then divide. Note that the tiles are given in inches and the backsplash is given in feet, so convert both to the same unit before calculating.

REMEMBER – "4-inch-square" means a square that is 4 inches on all sides, so a 4-inch-square piece of tile covers 4 x 4 = 16 square inches. (4-inch-square **is not** the same as 4 square inches.)

Square inches to be covered: Convert 4 feet to inches: 4 x 12 = 48 inches
                                                Convert 5 feet to inches: 5 x 12 = 60 inches
                                                48 x 60 = 2,880 sq in

Square inches in each piece of tile: 4 x 4 = 16 sq in

Divide to get number of tiles needed: 2,880 ÷ 16 = 180 tiles
Answer: D. 180

5. Suzanne is putting new wallpaper on both walls of her entryway. Each wall is 10 feet tall and 30 feet wide, and the wallpaper comes in rolls that are 3 feet wide and 10 feet tall. How many rolls of wallpaper will she need to cover both walls?

A. 10   **B. 20**   C. 30   D. 40   E. 50

You need to calculate the total square feet to be covered with wallpaper for 1 wall, the number of square feet in each roll of wallpaper, and then divide to see how many rolls of wallpaper are needed for 1 wall. Then multiply by 2 because there are 2 walls to be covered.

Square feet to be covered for each wall: 10 x 30 = 300 sq ft
Square feet in each roll of wallpaper: 3 x 10 = 30 sq ft
300 ÷ 30 = 10 rolls for each wall
10 rolls x 2 walls = 20 rolls for both walls
Answer: B. 20

6. Decorative mosaic tile wall covering comes in rolls that each cover 4 square feet. Which expression shows how many rolls will be needed to cover a 10 x 8 foot section of wall?

A. $\dfrac{10 \times 8}{4}$ B. $\dfrac{4}{10 \times 8}$ C. 4 x 8 x 10

D. $\dfrac{4 \times 10}{8}$ E. 10 x 8 + 4

You need to calculate the total square feet to be covered with tile, the number of square feet in each roll of tile, and then divide.
Note that you need an expression, not a numerical solution.

Square feet to be covered: 10 x 8
Square feet in each roll of tile: 4, as stated in the problem
Divide to get number of rolls of tile needed: (10 x 8) ÷ 4
None of the answer choices look like this, so convert to fraction form.
Answer: A. $\dfrac{10 \times 8}{4}$

NOTE – a roll that can "cover 4 square feet," as stated in problem #6, means the area of the roll is 4 sq ft.
This is different from a roll that is 4-foot-square, which would mean a roll that is square shaped measuring 4 feet on each side, with an area of 4 x 4 = 16 sq ft.

7. Pegboard is sold in 2-foot-square pieces that cost $4.49 each. How much will it cost to cover a section of workshop wall that is 4 feet tall and 8 feet wide?
A. $71.84   B. $143.68   C. $53.92   **D. $35.92**   E. $8

You need to calculate the total square feet to be covered with pegboard, and the number of square feet in each piece of pegboard. Then divide to get number of pieces of pegboard needed, and finally multiply x $4.49 to get cost.

Square feet to be covered: 4 x 8 = 32 sq ft
Square feet in each piece of pegboard: 2 x 2 = 4 sq ft
  (Remember "2-foot-square" means a square that is 2 feet on all sides.)
32 ÷ 4 = 8 pieces of pegboard needed
8 x $4.49 = $35.92
Answer: D. $35.92

8. A contractor needs to order enough drywall to cover 520 square feet of wall. How many 4 x 8 foot sheets of drywall should be ordered?
A. 16   **B. 17**   C. 43   D. 44   E. 71

You need to calculate the total square feet of wall to be covered, the number of square feet in each sheet of drywall, then divide.

Square feet to be covered: 520 sq ft, as stated in the problem
Square feet in each sheet of drywall: 4 x 8 = 32 sq ft
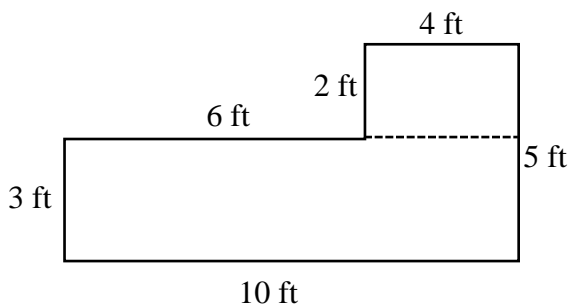520 ÷ 32 = 16.25 sheets of drywall
Don't round down, because 16 sheets will not be enough to do the job. Go up to 17.
Answer: B. 17

 Practice Two

1. What is the area of the diagram below?
A. 38 sq ft   B. 58 sq ft   C. 50 sq ft   D. 68 sq ft   E. 24 sq ft

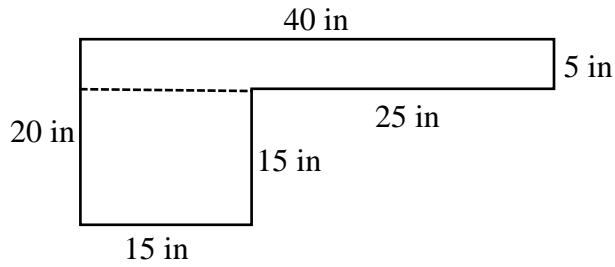Top rectangle area: 4 x 2 = 8 sq ft
Bottom rectangle area: 3 x 10 = 30 sq ft
Total area: 30 + 8 = 38 sq ft
Answer: A. 38 sq ft

4 ft

2 ft

6 ft

5 ft

3 ft

10 ft

2. What is the area of the figure below?

A. 500 sq in   B. 800 sq in   **C. 425 sq in**   D. 300 sq in   E. 95 sq in

40 in

5 in   Area of top rectangle: 5 x 40 = 200 sq in

20 in   25 in   Area of bottom rectangle: 15 x 15 = 225 sq in

15 in   Total area: 200 + 225 = 425 sq in

Answer: C. 425 sq in

15 in

3. What is the area of the corner of an office suite that holds the conference room and break room as shown in the diagram?

A. 780 sq ft   B. 540 sq ft   C. 1,125 sq ft   **D. 660 sq ft**   E. 390 sq ft
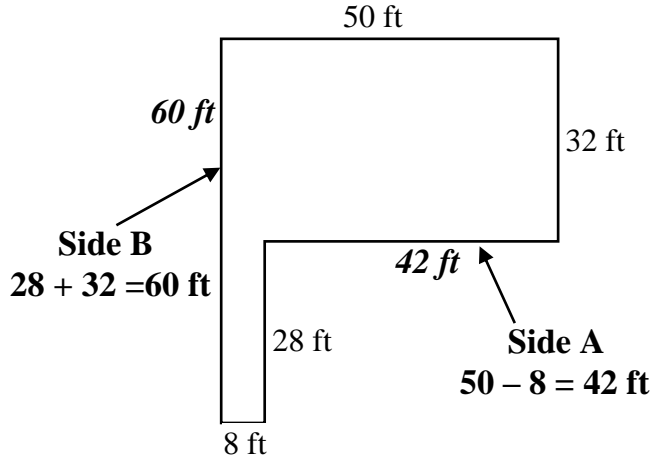
30 ft

Conference Room area: 18 x 30 = 540 sq ft

18 ft   Conference Room   Break Room area: 8 x 15 = 120 sq ft

Total area: 120 + 540 = 660 sq ft

Answer: D. 660 sq ft

Break Room

8 ft

15 ft

1. What is the perimeter of the figure shown below?

A. 118 ft   **B. 220 ft**   C. 212 ft   D. 110 ft   E. 400 ft

50 ft

60 ft

32 ft

Side B
28 + 32 = 60 ft

42 ft

28 ft

Side A
50 – 8 = 42 ft

8 ft

Calculate the two missing sides, then add up all the sides.

Side A: Use the other two sides that go in the same direction as Side A, 50 and 8.
     50 – 8 = 42 ft   Subtract because the missing side is shorter than 50.
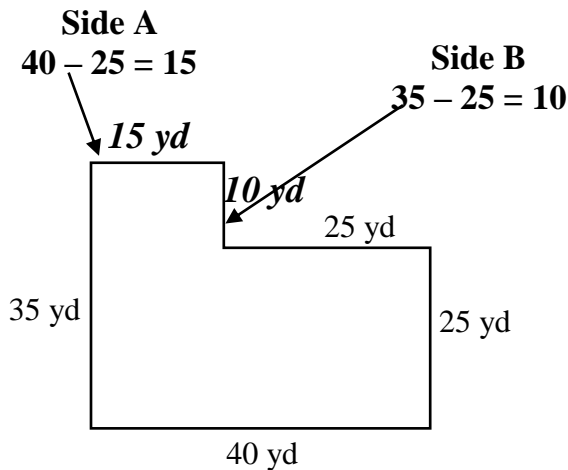
Side B: Use the other two sides that go in the same direction as Side B, 28 and 32.
     28 + 32 = 60 ft   Add because the missing side is longer than both 28 and 32.

Add up all the sides: 60 + 50 + 32 + 42 + 28 + 8 = 220 ft   **Answer: B. 220 ft**

2. How long will a fence need to be to surround the playground shown below?

A. 125 yd   B. 140 yd   C. 115 yd   **D. 150 yd**   E. 110 yd

Side A
40 – 25 = 15

Side B
35 – 25 = 10

15 yd

10 yd

25 yd

35 yd

25 yd

40 yd

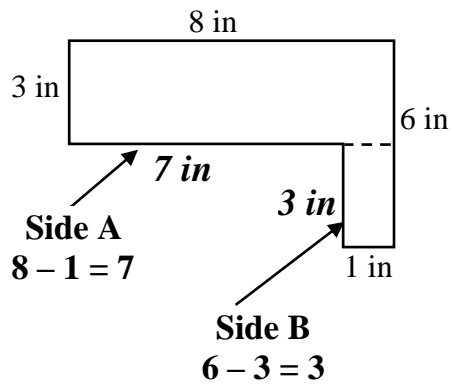Side A: 40 – 25 = 15 yd
Side B: 35 – 25 = 10 yd
Add up all the sides:
15 + 10 + 25 + 25 + 40 + 35 = 150 yd
Answer: D. 150 yd

3. Lina needs 12 pieces of fabric shaped like the diagram below for the quilt she is making. How many square inches will these pieces cover?

A. 27 sq in   B. 216 sq in   C. 28 sq in   D. 336 sq in   **E. 324 sq in**

8 in
3 in
6 in
7 in
3 in
Side A
8 – 1 = 7
1 in
Side B
6 – 3 = 3

Step 1: Calculate the missing sides.
                Side A: 8 – 1 = 7 in
                Side B: 6 – 3 = 3 in

Step 2: Divide into 2 rectangles to get area.
                Area of big rectangle: 3 x 8 = 24 sq in
                Area of small rectangle: 1 x 3 = 3 sq in
                Total area of 1 piece: 24 + 3 = 27 sq in
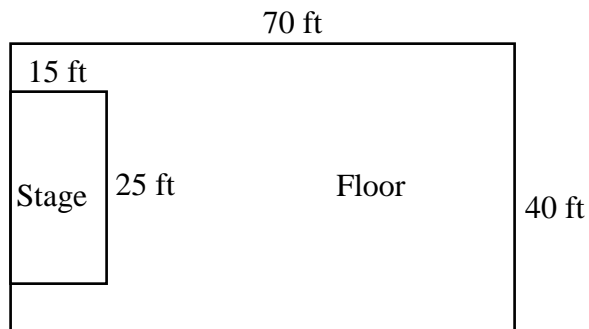
Step 3: Multiply to get area of all 12 pieces.
                Area of 12 pieces: 12 x 27 = 324 sq in

Answer: E. 324 sq in

Practice Four

1. The auditorium below is getting a new wooden floor, except for the stage area which will have a painted floor. What is the area that will be covered with wooden flooring?

A. 2,425 sq ft   B. 2,800 sq ft   C. 300 sq ft   D. 180 sq ft   E. 3,175 sq ft

70 ft
15 ft
Stage   25 ft   Floor
40 ft

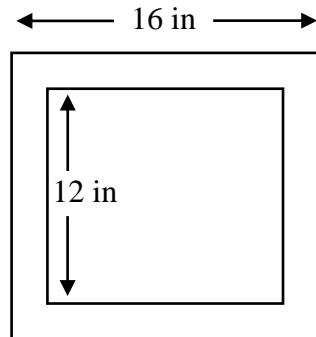Area of the whole auditorium (floor plus stage): 70 x 40 = 2,800 sq ft
Area of the stage: 15 x 25 = 375 sq ft
Subtract to get the floor area: 2,800 – 375 = 2,425 sq ft
Answer: A. 2,425 sq ft

2. A plain square wooden frame surrounding a square wall mirror is being decorated with mosaic tile. Based on the diagram below, what expression could you use to calculate the square inches of frame area that will be covered with mosaic tile?

A. (16 x 16) + (12 x 12)   **B. (16 x 16) – (12 x 12)**   C. 2(16 x 12)
D. (12 x 12) – (16 x 16)   E. (16 – 12) x (16 – 12)

16 in

12 in

Note that the problem tells you the frame and mirror are both squares.

All sides of the frame are 16 in.
All sides of the mirror are 12 in.
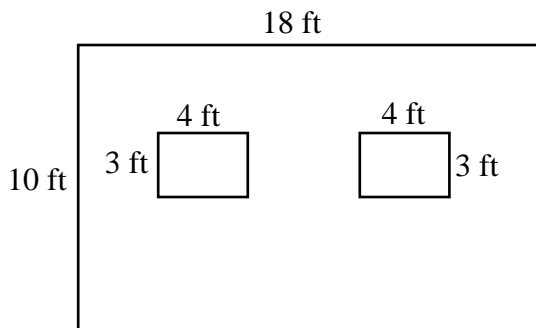
Area of the frame plus mirror together: 16 x 16
Area of the mirror: 12 x 12
Subtract to get the area of the frame: (16 x 16) – (12 x 12)
Answer: B. (16 x 16) – (12 x 12)

3. A wall with two windows is getting painted with an accent color. The wall measures 10 x 18 feet, and each window is 3 x 4 feet. Which expression would you use to calculate the area of the wall that will be painted?

A. (10 x 18) – (3 x 4)   B. (10 x 18) + (3 x 4)   **C. (10 x 18) – 2(3 x 4)**
D. (10 x 18) x 2(3 x 4)   E. 2(10 + 18) – 4(3 + 4)

18 ft

4 ft   4 ft

10 ft   3 ft   3 ft

Area of wall including windows: (10 x 18)
Area of each window: (3 x 4)
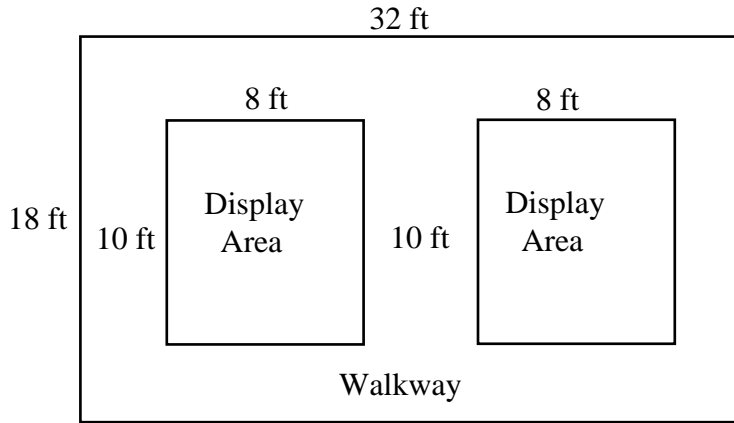Area of both windows: 2(3 x 4)
Subtract to get the area of the wall without the windows: (10 x 18) – 2(3 x 4)
Answer: C. (10 x 18) – 2(3 x 4)

4. A 32 by18 foot sculpture garden at a museum has a walkway built around and through two display areas, as shown below. To complete the project, the walkway will be tiled with tiles that cost $4 per square foot, and a guardrail that costs $12 per foot will be built around each 8 ft x 10 ft display area. How much will it cost to complete the project?

A. $1,664   B. $3,584   C. $2,624   D. $2,096   **E. $2,528**

```
                            32 ft
         ┌──────────────────────────────────────────┐
         │         8 ft                  8 ft        │
         │     ┌──────────┐          ┌──────────┐    │
         │     │          │          │          │    │
         │     │ Display  │          │ Display  │    │
   18 ft │10 ft│  Area    │   10 ft  │  Area    │    │
         │     │          │          │          │    │
         │     │          │          │          │    │
         │     └──────────┘          └──────────┘    │
         │              Walkway                      │
         └──────────────────────────────────────────┘
```

Step 1: Calculate the cost of the tile for the walkway.
Area: (18 x 32) – (8 x 10) – (8 x 10) = 416 sq ft
Cost: $4 x 416 sq ft = $1,664

Step 2: Calculate the cost of the guardrails that goes around the two display areas.
Guardrails go around the edge, so calculate perimeter.
Perimeter of one display area: 8 + 8 + 10 + 10 = 36 ft
Perimeter of both display areas: 2 x 36 =72 ft
Cost: $12 x 72 ft = $864

Step 3: Add the two costs together.
$1,664 + $864 = $2,528
Answer: E. $2,528
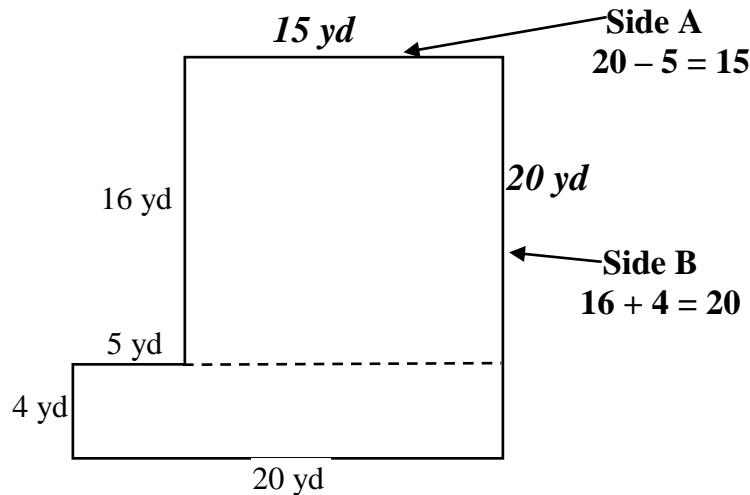
Questions 1 and 2 refer to the diagram below.

1. The area in the diagram will be paved with outdoor tile, and a border of stepping stones will be placed around the outside edge. How many square yards of outdoor tile will be needed?

A. 400 sq yd   B. 80 sq yd   C. 300 sq yd   D. 325 sq yd   **E. 320 sq yd**

Square yards means to calculate area.
First, calculate the missing sides.
Then, divide into 2 rectangles, calculate the area of each rectangle, and add together.

Side A
20 − 5 = 15

15 yd

16 yd

20 yd

Side B
16 + 4 = 20

5 yd

4 yd

20 yd

Side A: 20 − 5 = 15 yd
Side B: 16 + 4 = 20 yd
Area of top rectangle: 15 x 16 = 240 sq yd
Area of bottom rectangle: 4 x 20 = 80 sq yd
Total area: 240 + 80 = 320 sq yd
Answer: E. 320 sq yd

2. How long will the stepping stone border be?
A. 80 yd   B. 60 yd   C. 85 yd   D. 45 yd   E. 65 yd

A border around the edge means perimeter. Add up the lengths of all the sides.
Perimeter = 20 + 4 + 5 + 16 + 15 + 20 = 80 yd
Answer: A. 80 yd

3. A micro-tile backsplash material is sold in 4 x 1 foot sections, and Adel wants to use it on her backsplash area that measures 3 x 8 feet. Which expression shows how many micro-tile sections are needed?

A. $\dfrac{4}{3 \times 8}$ B. (3 x 8) x 4   **C.** $\dfrac{\mathbf{3 \times 8}}{\mathbf{4}}$ D. 2(3 + 8) + 2(4 + 1)   E. 3 x 4 ÷ 8

Total square feet to be covered, or area: 3 x 8
The number of square feet in each micro-tile section: 4 x 1 = 4
Divide to get number of sections: (3 x 8) ÷ 4
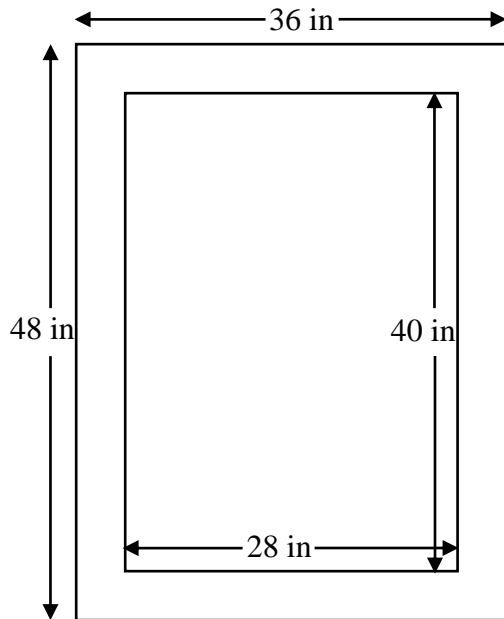**Answer: C.** $\dfrac{\mathbf{3 \times 8}}{\mathbf{4}}$

NOTE – The division sign is like a fraction bar. (3 x 8) ÷ 4 can also be expressed as:
$\dfrac{3 \times 8}{4}$ or $\dfrac{8 \times 3}{4}$

4. Lenore is making posters to advertise a New Year's Eve party, as shown in the diagram below. Each poster will have a border made from fancy metallic fireworks pattern paper. Which expression could you use to calculate the number of square inches of fireworks pattern paper that Lenore will need for each poster?

A. (48 x 36) + (28 x 40)   **B. (48 x 36) – (28 x 40)**   C. (48 x 28) – (40 x 36)
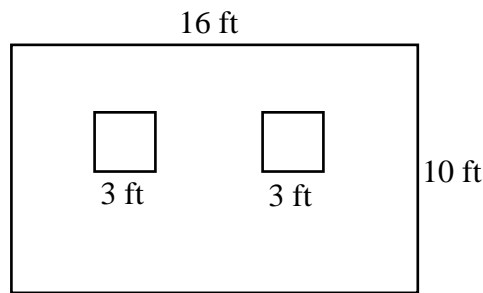D. (48 x 28) x (40 x 36)   E. 2(48 + 36) + 2(28 x 40)

Area of whole poster: 48 x 36
Area of center of poster: 28 x 40
Subtract to get border: (48 x 36) – (28 x 40)
Answer: **B. (48 x 36) – (28 x 40)**

5. How much will it cost to carpet the room shown in the diagram below if carpeting costs $3.99 per square foot?

A. $180   B. $143.64   C. $430.92   **D. $718.20**   E. $798

Step 1: Calculate the missing sides.
Side A: $10 - 6 = 4$ ft
Side B: $15 + 5 = 20$ ft

Step 2: Calculate area.
Top rectangle: $6 \times 20 = 120$ sq ft
Bottom rectangle: $4 \times 15 = 60$ sq ft
Total area: $120 + 60 = 180$ sq ft

Step 3: Calculate cost.
$180 \times \$3.99 = \$718.20$
Answer: D. $718.20

6. How many 2-foot-square ceiling tiles will be needed to cover the ceiling in a room that is 16 feet long and 20 feet wide?

A. 160   B. 144   C. 36   D. 320   **E. 80**

Remember that 2-foot-square means a square that is 2 feet on all sides, so each tile has an area of $2 \times 2 = 4$ sq ft. (2-foot-square **does not** mean 2 square feet.)

Divide total square feet to be covered by the number of square feet in each tile.
Total square feet to be covered: $16 \times 20 = 320$ sq ft
Square feet in each tile: $2 \times 2 = 4$ sq ft
$320 \div 4 = 80$ tiles
Answer: E. 80

Questions 7 – 9 refer to the diagram below of a wall with 2 square windows.

16 ft

3 ft 3 ft

10 ft

7. The wall in the diagram will be painted, not including the 2 square windows. Which expression shows how many square feet of wall will be painted?
A. (16 x 10) – (3 x 3) **B. (16 x 10) – 2(3 x 3)** C. 2(16 x 10) – (3 + 3)
D. 2(16 x 10) – 2(3 x 3) E. (16 x 10) ÷ 2(3 x 3)

Total area of wall including windows: 16 x 10
Area of each window: 3 x 3 (Windows are square – see note above diagram.)
Area of wall without windows: (16 x 10) – 2(3 x 3) **Answer: B. (16 x 10) – 2(3 x 3)**

8. In the Gateway Apartment Complex, there are 26 walls exactly like the wall in the diagram that need to be painted. If one gallon of paint covers 400 square feet of wall, how many gallons of paint will need to be purchased to cover the 26 walls?
A. 9 **B. 10** C. 15 D. 8 E. 12

Square feet in 1 wall (from answer to problem #8): (16 x 10) – 2(3 x 3) = 142 sq ft
Square feet in 26 walls: 26 x 142 = 3,692 sq ft
Each gallon covers 400 sq ft, so divide square feet to be covered by 400.
3,692 ÷ 400 = 9.23 gallons
Normally, 9.23 would round down to 9.
In this problem you have to go up to 10 gallons because 9 gallons of paint would not be enough to do the job. **Answer: B. 10**

9. They are also putting new glass in all the windows in the 26 walls. If glass costs $5 per square foot, what will it cost to buy the glass for all the windows?
A. $468 B. $1,170 C. $1,560 **D. $2,340** E. $4,160

Number of windows needing glass: 26 x 2 = 52
Square feet in each window: 3 x 3 = 9 sq ft
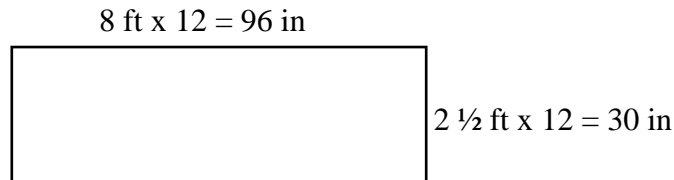Total glass needed: 52 x 9 = 468 sq ft
Cost of glass: $5 x 468 = $2,340 **Answer: D. $2,340**

10. Decorative tiles for a kitchen backsplash measure 2 inches wide and 2 inches long. How many of these tiles will be needed to cover a backsplash area that is 2 ½ feet by 8 feet?

A. 10   **B. 720**   C. 5   D. 1,440   E. 270

The tiles are measured in inches, and the area to be covered is measured in feet, so everything must be converted to the same unit. It will be easier to convert the feet to inches, than the inches to feet.

8 ft x 12 = 96 in

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┌─────────────────────────────┐
│                             │   2 ½ ft x 12 = 30 in
│                             │
└─────────────────────────────┘
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Area of each tile: 2 x 2 = 4 sq in
Area to be covered: 96 x 30 = 2,880 sq in
Tiles needed: 2,880 ÷ 4 = 720 tiles
Answer: B. 720

11. A 12 by 24 inch decorative wall quilt is being put together with pre-cut quilt pieces that are each 4 inches long and 1 inch wide. Which expression shows how many quilt pieces will be needed?

A. (12 x 24) x 4   B. 2(12 + 24) ÷ 4   **C. (12 x 24) ÷ 4**
D. 2(12 + 24) x 4   E. (12 x 24) + 4

Area of quilt: 12 x 24
Area of each quilt piece: 4 x 1 = 4
Divide to get number of pieces: (12 x 24) ÷ 4
Answer: C. (12 x 24) ÷ 4

12. For the quilt being made in problem #11, the quilt pieces come in packs of 10 that cost $2.75 per pack. How much will it cost to buy enough quilt pieces?

A. $72   B. $19.25   C. $27.50   D. $198   **E. $22**

Number of quilt pieces needed (from problem #12): (12 x 24) ÷ 4 = 72
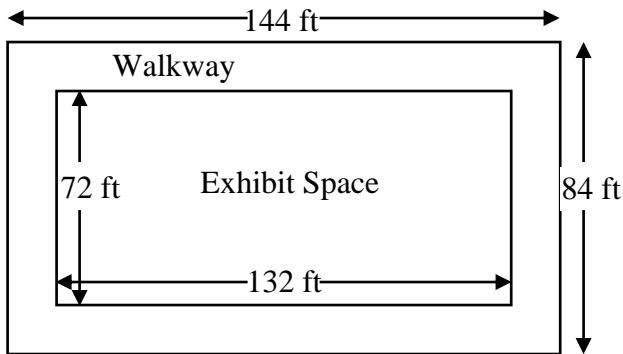Number of packs needed: 72 ÷ 10 = 7.2 → 8
     Go up to 8 packs, since 7 packs will not be enough to provide
     the 72 needed pieces.
Cost: 8 x $2.75 = $22
Answer: E. $22

13. At the zoo, there is a rectangular wild bird exhibit space with a walkway going around all four sides, as shown in the diagram below. What expression would you use to calculate the area of the walkway?

A. 84 x 144   **B. (84 x 144) – (72 x 132)**   C. 72 x 132

D. (84 x 144) + (72 x 132)   E. (72 x 144) – (84 x 132)

Total area of exhibit space plus walkway: 84 x 144
Area of exhibit space: 72 x 132
Subtract to get the area of the walkway: (84 x 144) – (72 x 132)
Answer: B. (84 x 144) – (72 x 132)

14. The bathroom shown is getting a new tile floor. Which expression could be used to show how many square feet of tile are needed, assuming that the area under the bathtub will not be tiled?

A. (15 x 10) – (3 x 6)   B. (15 x 10) + (3 x 6)   C. (15 x 10) x (3 x 6)

D. (15 x 10) ÷ (3 x 6)   E. (15 x 6) – (3 x 10)

Area of bathroom including bathtub: 15 x 10
Area of bathtub: 3 x 6
Subtract to get area to be tiled: (15 x 10) – (3 x 6)
Answer: A. (15 x 10) – (3 x 6)

15. Acoustical ceiling tile is being installed in a workroom that is 72 feet long and 44 feet wide. If each tile covers 8 square feet, which of the following expressions would you use to calculate the number of tiles needed?

A. 72 x 44 x 8   B. 2(72 + 44) ÷ 8   C. 72 ÷ 8 + 44 ÷ 8

D. 2(72 + 44) x 8   **E. (72 x 44) ÷ 8**

Square feet to be covered: 72 x 44
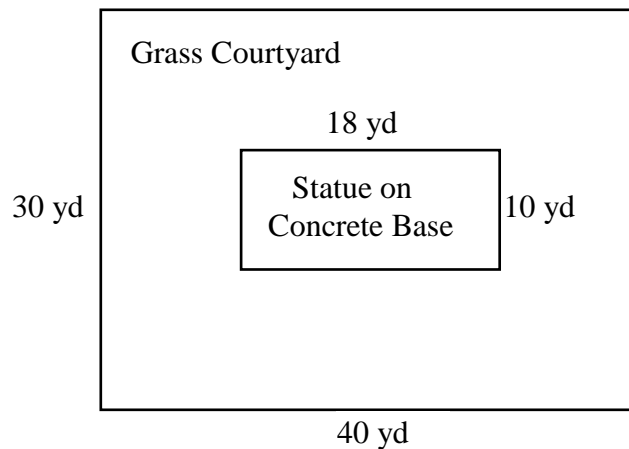Square feet in each tile: 8, as stated in the problem
Divide to get number of tiles needed: (72 x 44) ÷ 8
Answer: E. (72 x 44) ÷ 8

16. The grass courtyard at Boone Town Hall has a statue on a concrete rectangular base as shown in the diagram. If the grass part of the courtyard is being reseeded at a cost of $1.75 per square yard, how much will the reseeding job cost?

A. $1,785   B. $1,200   C. $1,020   D. $686   E. $1,875

Area of courtyard including concrete base: 30 x 40 = 1,200 sq yd
Area of concrete base: 10 x 18 = 180 sq yd
Area of grass part of courtyard alone: 1,200 – 180 = 1,020 sq yd
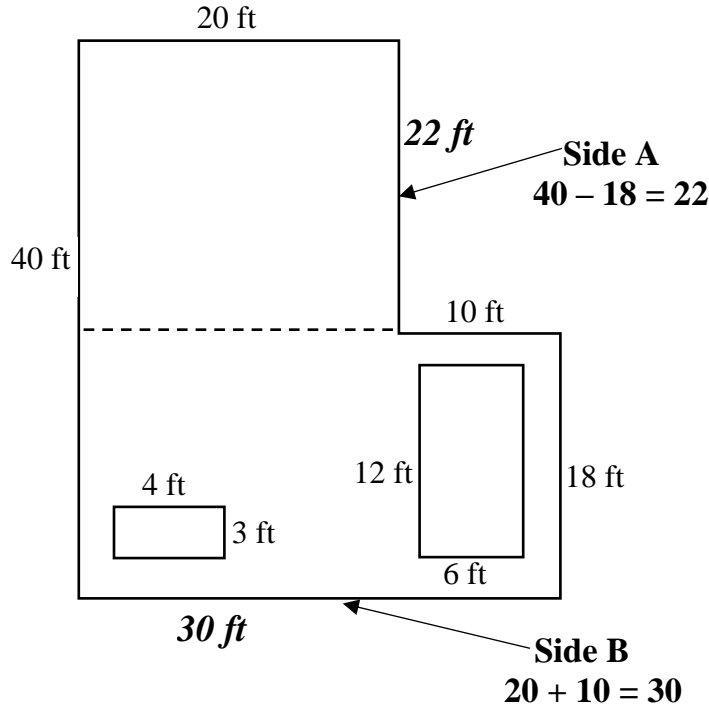Cost: 1,020 sq yd x $1.75 per sq yd = $1,785
Answer: A. $1,785

*** → Multi-Step Challenger ← ***

The layout of Primo Coffee Corner is shown below. There is a 12 by 6 foot counter/coffee station and a 3 by 4 foot condiment station. New wood flooring is being installed everywhere except under these two stations. How much will it cost to install the flooring if the charge is $8 per square foot?

A. $5,728   B. $8,928   C. $7,618   **D. $7,168**   E. $1,120

20 ft

22 ft — Side A
40 – 18 = 22

40 ft

10 ft

4 ft
3 ft
12 ft   18 ft
6 ft

30 ft — Side B
20 + 10 = 30

Step 1: Divide into 2 rectangles and calculate any missing sides that are needed to get area.
Side A: 40 – 18 = 22 ft
Side B: 20 + 10 = 30 ft

Step 2: Calculate area.
Top Rectangle: 20 x 22 = 440 sq ft
Bottom Rectangle: 30 x 18 = 540 sq ft
Total Area: 440 + 540 = 980 sq ft

Step 3: Calculate area of two stations that will not get flooring, and subtract from total area.
Big Station: 6 x 12 = 72 sq ft
Small Station: 3 x 4 = 12 sq ft
Area that will get flooring: 980 – 72 – 12 = 896 sq ft

Step 4: Calculate Cost
896 sq ft x $8 per sq ft = $7,168

Answer: D. $7,168