ALBERT

Name _____ Date _____

Geometric Design Problems Worksheet

Geometry · Common Core HSG-MG.A.3

> Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Practice

Builds the skill step by step.

1. A rectangle has a perimeter of 20. What is the largest area it can have?

2. A rectangular garden uses a wall as one side and 40 ft of fencing for the other three. The sides perpendicular to the wall are 10 ft each. What is its area?

3. An open box is made from a 10 in by 10 in sheet by cutting 2 in squares from each corner and folding up. What is its volume?

4. A poster has a width-to-height ratio of 2 : 3. It is 20 in wide. How tall is it?

5. A ramp must rise 1 in for every 12 in of run. It needs to rise 30 in. How long is the run?

6. How many 1 ft by 1 ft tiles cover a 12 ft by 15 ft floor?

7. Fencing costs 12 dollars per foot. How much does it cost to fence a 30 ft by 20 ft yard?

8. A rectangle uses the golden ratio, length : width ≈ 1.618 : 1. Its width is 10. What is its length, to the nearest tenth?

9. One gallon of paint covers 350 ft^2. The walls total 1,050 ft^2. How many gallons are needed?

10. A can label wraps a cylinder with radius 3 in and height 10 in. What is the label's area? Use 3.14 for π and round to the nearest tenth.

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On Level

Grade-level practice.

1. A rectangle has a perimeter of 36. What is the largest area it can have?

2. A can must hold 1000 cm^3 and have radius 5 cm. How tall must it be? Use 3.14 for π and round to the nearest tenth.

3. An open box is made from a 12 in by 12 in sheet by cutting 2 in squares from each corner. What is its volume?

4. A page is 8.5 in wide with 1 in margins on each side. The text area is split into 3 equal columns with two 0.25 in gutters between them. How wide is each column?

5. A rectangular pen must have an area of 64 ft^2. What is the least fencing it can use?

6. A closed cylindrical tank has radius 1 m and height 2 m. Its surface area is $2\pi r^2 + 2\pi rh$. Material costs 5 dollars per m^2. Use 3.14 for π. What does the material cost?

7. A floor plan uses the scale 1 in : 4 ft. A room is 15 ft long. How long is it on the plan?

8. A box must hold 240 in^3 and have an 8 in by 6 in base. How tall must it be?

9. A cell tower must be the same distance from three towns. Where should it go?

   A. at any vertex

   B. at the centroid

   C. at the circumcenter of the triangle formed by the towns

   D. at the incenter

10. A fence of 40 m can enclose a square or a circle. Show which encloses more area. Use 3.14 for π.

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Challenge

Multi-step and word problems that stretch it.

1. A rectangular field along a river needs fencing on three sides only, with 600 m of fencing. What is the largest area it can have?

2. An open box is made from a 20 in by 20 in sheet by cutting 3 in squares from each corner. What is its volume?

3. A cylinder with radius equal to its height must hold 1,570 cm^3. Use 3.14 for π. What is its radius, to the nearest tenth?

4. A cone-shaped paper cup has radius 4 cm and slant height 10 cm. Its side uses $\pi r\ell$ square cm of paper. How much paper is that? Use 3.14 for π and round to the nearest tenth.

5. A design uses pages with a width-to-height ratio of 1 : 1.5. A page is 600 px wide. How tall is it?

6. A window is a 4 ft wide rectangle, 5 ft tall, topped by a semicircle with diameter 4 ft. What is its total area? Use 3.14 for π and round to the nearest tenth.

7. With 100 ft of fencing, how much more area does a square pen enclose than a 20 ft by 30 ft pen?

8. A cylindrical tank must hold 100 m^3 and have radius 2 m. How tall must it be? Use 3.14 for π and round to the nearest tenth.

9. A 1,000 px wide web page uses a 12-column grid with 20 px gutters between neighboring columns (11 gutters). How wide is each column?

10. For a closed can of fixed volume, which shape uses the least material?

    A. The height equals the diameter.

    B. The height is twice the diameter.

    C. The height equals the radius.

    D. Very tall and thin.