1. In the diagram, what is the length of BC?
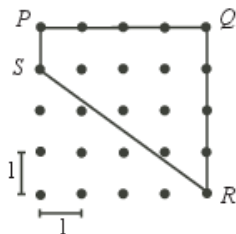

    (A) 13   (B) 12   (C) 20   (D) 16   (E) 17

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2. In the diagram, what is the perimeter of $\triangle PQS$?
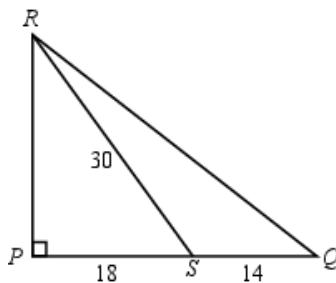

    (A) 74   (B) 55   (C) 80   (D) 84   (E) 97

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3. In the diagram, the horizontal distance between adjacent dots in the same row is 1. Also, the vertical distance between adjacent dots in the same column is 1. What is the perimeter of quadrilateral $PQRS$?
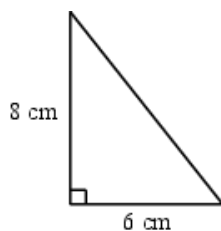

    (A) 12   (B) 13   (C) 14   (D) 15   (E) 16

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4. In $\triangle PQR$, $\angle RPQ = 90°$ and S is on PQ. If $SQ = 14$, $SP = 18$, and $SR = 30$, then the area of $\triangle QRS$ is

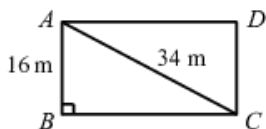(A) 84   (B) 168   (C) 210   (D) 336   (E) 384

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5. There is a square whose perimeter is the same as the perimeter of the triangle shown. The area of that square is

8 cm

6 cm

(A) 12.25 cm^2 (B) 196 cm^2 (C) 49 cm^2 (D) 36 cm^2 (E) 144 cm^2
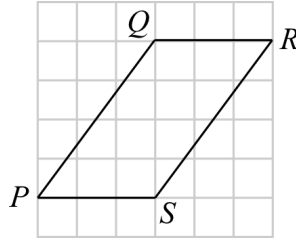
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6. A line segment joins the points $P(-4, 1)$ and $Q(1, -11)$. What is the length of PQ?
(A) 13   (B) 12   (C) 12.5   (D) 13.6   (E) 12.6

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7. Rectangle $ABCD$ has side length $AB = 16$ m and diagonal length $AC = 34$ m, as shown. The perimeter of rectangle $ABCD$ is

A D
16 m   34 m
B C

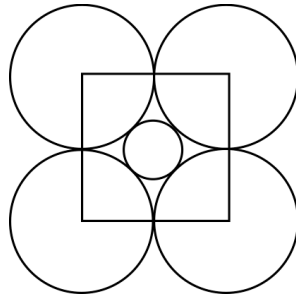(A) 46 m   (B) 126 m   (C) 100 m   (D) 92 m   (E) 240 m

8. In the diagram, points P, Q, R, and S are at intersections of gridlines in a 6×6 grid.

What is the perimeter of parallelogram $PQRS$?

(A) 14　　　(B) 15　　　(C) 16　　　(D) 17　　　(E) 18

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9. Four larger circles with radius 5 are arranged so that their centres are the vertices of a square. Each of the larger circles is tangent to (that is, just touches) two of the other circles, as shown.
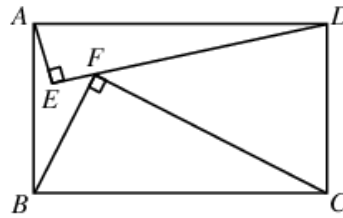

A smaller circle with radius r is drawn in the region between the four larger circles. The smaller circle is tangent to each of the larger circles. The value of r is closest to

(A) 1.9　　　(B) 2.0　　　(C) 2.1　　　(D) 2.2　　　(E) 2.3

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10. Equilateral triangle ABC has sides of length 4. The midpoint of BC is D, and the midpoint of AD is E. The value of EC^2 is
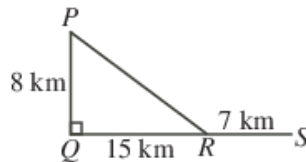
(A) 7　　　(B) 6　　　(C) 6.25　　　(D) 8　　　(E) 10

11. In the diagram, right-angled triangles AED and BFC are constructed inside rectangle $ABCD$ so that F lies on DE. If $AE = 21$, $ED = 72$ and $BF = 45$, what is the length of AB?
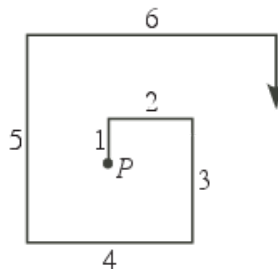

(A) 50   (B) 48   (C) 52   (D) 54   (E) 56

12. Asafa ran at a speed of 21 km/h from P to Q to R to S, as shown. Florence ran at a constant speed from P directly to R and then to S. They left P at the same time and arrived at S at the same time. How many minutes after Florence did Asafa arrive at point R?
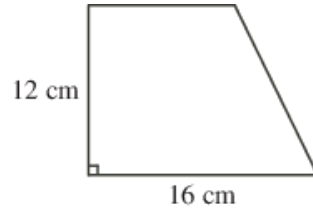

(A) 0   (B) 8   (C) 6   (D) 7   (E) 5

13. Starting at point P, Breenah constructs a straight sided spiral so that:
   - all angles are $90°$
   - after starting with a line segment of length 1, each side is 1 longer than the previous side.

After completing the side with length 21, Breenah's distance from her original starting point P will be between
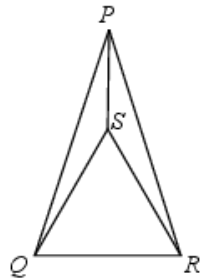

(A) 13 and 14   (B) 14 and 15   (C) 15 and 16   (D) 16 and 17   (E) 17 and 18

14. The trapezoid shown has a height of length 12 cm, a base of length 16 cm, and an area of 162 cm². The perimeter of the trapezoid is
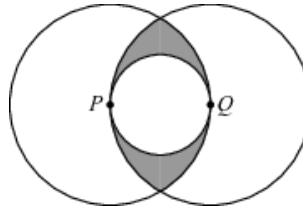

(A) 51 cm   (B) 52 cm   (C) $49.\overline{6}$ cm   (D) 50 cm   (E) 56 cm

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15. In the diagram, $\triangle PQR$ is isosceles with $PQ = PR = 39$ and $\triangle SQR$ is equilateral with side length 30. The area of $\triangle PQS$ is closest to
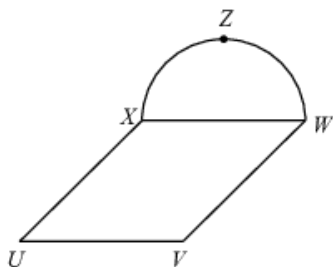

(A) 68   (B) 75   (C) 50   (D) 180   (E) 135

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16. In the diagram, two larger circles with radius 1 have centres P and Q. Also, the smaller circle has diameter PQ. The region inside the two larger circles and outside the smaller circle is shaded.
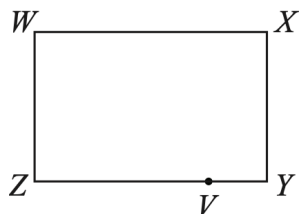

The area of the shaded region is closest to
(A) 0.36   (B) 0.38   (C) 0.40   (D) 0.42   (E) 0.44

17. In the diagram, $UVWX$ is a rectangle that lies flat on a horizontal floor. A vertical semi-circular wall with diameter XW is constructed. Point Z is the highest point on this wall. If $UV = 20$ and $VW = 30$, the perimeter of $\triangle UVZ$ is closest to
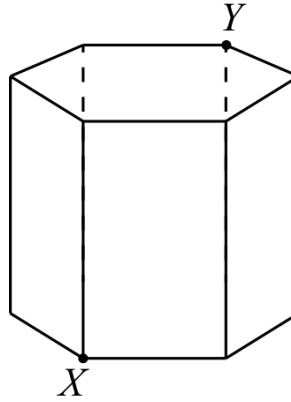

(A) 95   (B) 86   (C) 102   (D) 83   (E) 92

18. Rectangle $WXYZ$ has $WX = 4$, $WZ = 3$, and $ZV = 3$.

The rectangle is curled without overlapping into a cylinder so that sides WZ and XY touch each other. In other words, W touches X and Z touches Y. The shortest distance from W to V through the inside of the cylinder can be written in the form $\sqrt{\dfrac{a + b\pi^2}{c\pi^2}}$ where a, b and c are positive integers. The smallest possible value of $a + b + c$ is

(A) 12   (B) 26   (C) 18   (D) 19   (E) 36

19. A hexagonal prism has a height of 165 cm. Its two hexagonal faces are regular hexagons with sides of length 30 cm. Its other six faces are rectangles.

A fly and an ant start at point X on the bottom face and travel to point Y on the top face. The fly flies directly along the shortest route through the prism. The ant crawls around the outside of the prism along a path of constant slope so that it winds around the prism exactly $n + \frac{1}{2}$ times, for some positive integer n. The distance crawled by the ant is more than 20 times the distance flown by the fly. What is the smallest possible value of n?

20. Points $A(-3, 5)$, $B(0, 7)$ and $C(r, t)$ lie along a line. If $BC = 4AB$ and $r > 0$, what is the value of $r + t$?