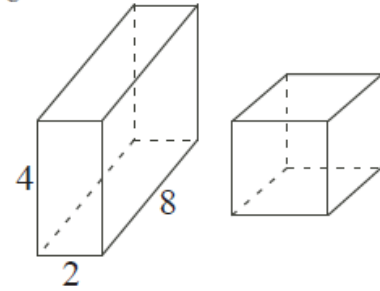**Math 9 Honours Chapter 1: 2D shapes and 3D solids**

1
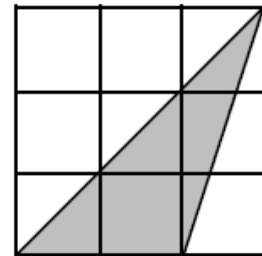
In the diagram, the rectangular solid and the cube have equal volumes. The length of each edge of the cube is

(A) 2   (B) 4   (C) 8
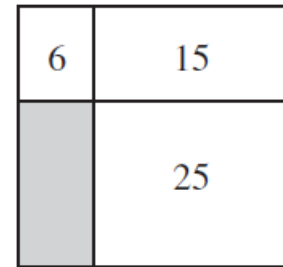
(D) 16   (E) 32

2

In the diagram, each small square is 1 cm by 1 cm. The area of the shaded region, in square centimetres, is

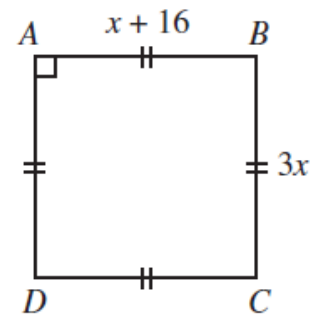(A) 2.75   (B) 3   (C) 3.25
(D) 4.5   (E) 6

3

A rectangle is divided into four smaller rectangles. The areas of three of these rectangles are 6, 15 and 25, as shown. The area of the shaded rectangle is

(A) 7   (B) 15   (C) 12
(D) 16   (E) 10

4

$ABCD$ is a square with $AB = x + 16$ and $BC = 3x$, as shown. The perimeter of $ABCD$ is

(A) 16   (B) 32   (C) 96
(D) 48   (E) 24

5

The surface area of a large cube is 5400 cm². This cube is cut into a number of identical smaller cubes. Each smaller cube has a volume of 216 cm³. How many smaller cubes are there?
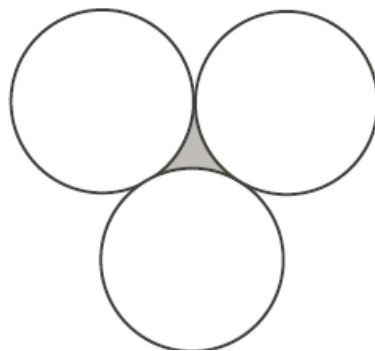
(A) 25   (B) 125   (C) 164   (D) 180   (E) 216

(D) −6   (E) 24

In the diagram, each of the three identical circles touch the other two. The circumference of each circle is 36. What is the perimeter of the shaded region?
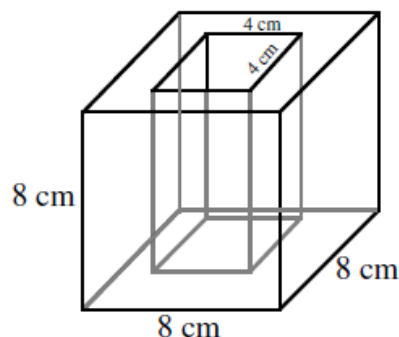
(A) 18   (B) 6   (C) 36

(D) 12   (E) 24

7

An 8 cm cube has a 4 cm square hole cut through its centre, as shown. What is the remaining volume, in cm^3?
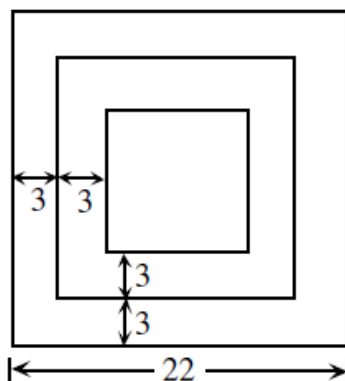
(A) 64   (B) 128   (C) 256
(D) 384   (E) 448

4 cm
4 cm
8 cm
8 cm
8 cm

8

Three squares with the same centre and corresponding parallel sides are drawn. The distance between the sides of successive squares is 3 and the side length of the largest square is 22, as shown. What is the perimeter of the smallest square?
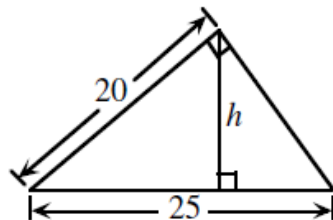
(A) 40   (B) 100   (C) 10
(D) 64   (E) 20

3   3
3
3
22

9

In the diagram, the value of the height h is

(A) 6   (B) 9   (C) 10
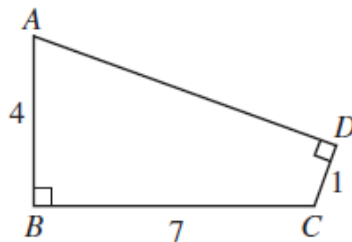(D) 12   (E) 15

20
h
25

10

A wooden rectangular prism has dimensions 4 by 5 by 6. This solid is painted green and then cut into 1 by 1 by 1 cubes. The ratio of the number of cubes with exactly two green faces to the number of cubes with three green faces is

(A) 9:2   (B) 9:4   (C) 6:1   (D) 3:1   (E) 5:2

11

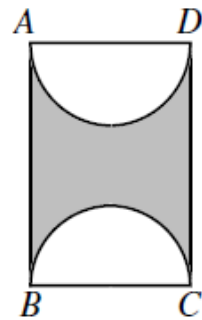In the diagram, what is the area of quadrilateral $ABCD$?

(A) 14   (B) 16   (C) 18
(D) 20   (E) 28

A
4
D
B   7   C
1

12 | *ABCD* is a rectangle with *AD* = 10. If the shaded area is 100, then the shortest distance between the semicircles is

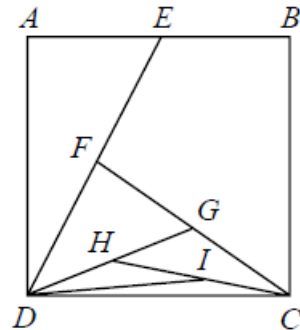(A) 2.5π (B) 5π (C) π

(D) 2.5π + 5 (E) 2.5π − 2.5

13 | Square *ABCD* has an area of 4. *E* is the midpoint of *AB*. Similarly, *F*, *G*, *H*, and *I* are the midpoints of *DE*, *CF*, *DG*, and *CH*, respectively. The area of △*IDC* is
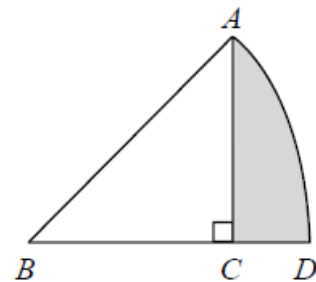
(A) $\frac{1}{4}$ (B) $\frac{1}{8}$ (C) $\frac{1}{16}$

(D) $\frac{1}{32}$ (E) $\frac{1}{64}$

14 | In the diagram, *AB* and *BD* are radii of a circle with centre *B*. The area of sector *ABD* is 2π, which is one-eighth of the area of the circle. The area of the shaded region is
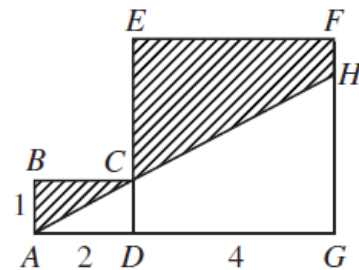
(A) 2π − 4 (B) π (C) 2π − 2

(D) 2π − 4.5 (E) 2π − 8

15 | In the diagram, *DEFG* is a square and *ABCD* is a rectangle. A straight line is drawn from *A*, passes through *C* and meets *FG* at *H*. The area of the shaded region is
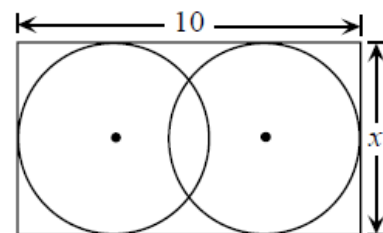
(A) 8 (B) 8.5 (C) 10

(D) 9 (E) 10.5

16 | Two circles with equal radii are enclosed by a rectangle, as shown. The distance between their centres is $\frac{2x}{3}$. The value of *x* is

(A) $\frac{15}{4}$ (B) 5 (C) 6

(D) $\frac{60}{7}$ (E) $\frac{15}{2}$

17

Eight unit cubes are used to form a larger 2 by 2 by 2 cube. The six faces of this larger cube are then painted red. When the paint is dry, the larger cube is taken apart. What fraction of the total surface area of the unit cubes is red?
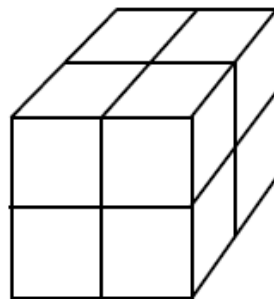
(A) $\frac{1}{6}$ (B) $\frac{2}{3}$ (C) $\frac{1}{2}$

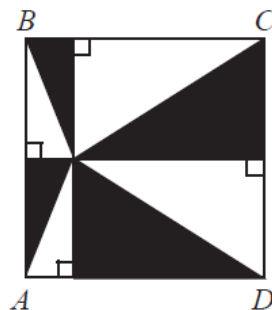(D) $\frac{1}{4}$ (E) $\frac{1}{3}$

18

The area of square $ABCD$ is 64. The midpoints of its sides are joined to form the square $EFGH$. The midpoints of its sides are J, K, L, and M. The area of the shaded region is
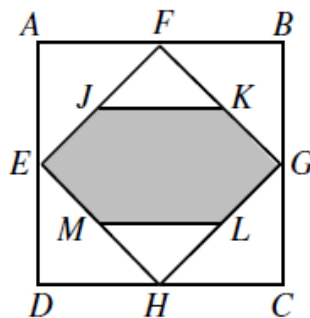
(A) 32   (B) 24   (C) 20

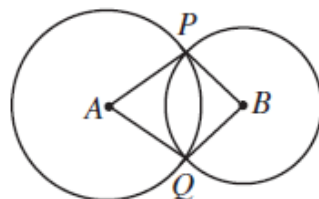(D) 28   (E) 16

19

In the diagram, square $ABCD$ has a side length of 4. What is the total area of the shaded regions?

(A) 4   (B) 8   (C) 9

(D) 12   (E) 16

20

In the diagram, two circles with centres A and B intersect at points P and Q so that $\angle PAQ = 60°$ and $\angle PBQ = 90°$. What is the ratio of the area of the circle with centre A to the area of the circle with centre B?

(A) 3:1   (B) 3:2   (C) 4:3

(D) 2:1   (E) 9:4

21

In the diagram, ABC is a semi-circle with diameter AC, centre O and radius 1. Also, OB is perpendicular to AC. Using AB as a diameter, a second semi-circle AEB is drawn. The region inside this second semi-circle that lies outside the original semi-circle is shaded, as shown. The area of this shaded region is
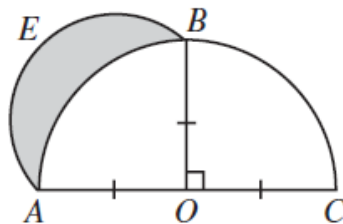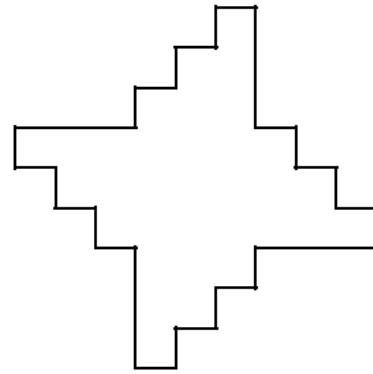
(A) $\frac{\pi}{4}$ (B) $\frac{1}{2}$ (C) $\frac{3\pi}{4} + \frac{1}{2}$

(D) $\frac{3}{4}$ (E) $\frac{\pi}{2} - \frac{1}{2}$

22

In the diagram adjacent edges are at right angles. The four longer edges are equal in length, and all of the shorter edges are also equal in length. The area of the shape is 528. What is the perimeter?

(A) 132　　　　(B) 264　　　　(C) 144

(D) 72　　　　(E) 92

23

A sealed bottle, which contains water, has been constructed by attaching a cylinder of radius 1 cm to a cylinder of radius 3 cm, as shown in Figure A. When the bottle is right side up, the height of the water inside is 20 cm, as shown in the cross-section of the bottle in Figure B. When the bottle is upside down, the height of the liquid is 28 cm, as shown in Figure C. What is the total height, in cm, of the bottle?
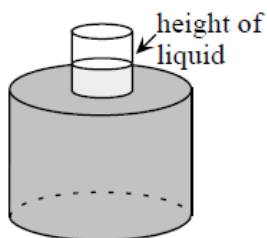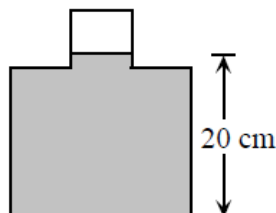
height of liquid
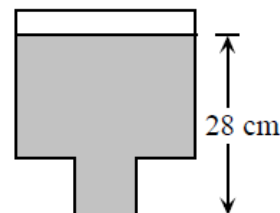
Figure A　　　　Figure B　　20 cm　　Figure C　　28 cm

(A) 29　　　　(B) 30　　　　(C) 31　　　　(D) 32　　　　(E) 48

24

A container in the shape of a cube has edge length 20 cm and contains some water. A solid gold cube, with edge length 15 cm, sinks to the bottom of this container, causing the water level to rise just to the top of the *solid* cube. Which of the following is closest to the original depth of the water?
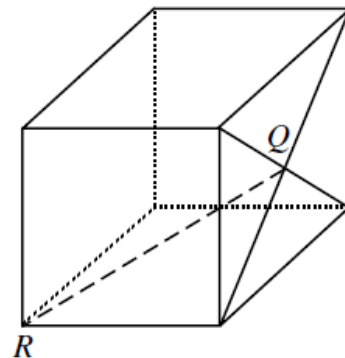
(A) 6.56 cm　　　　(B) 8.25 cm　　　　(C) 10.50 cm

(D) 5.31 cm　　　　(E) 7.50 cm
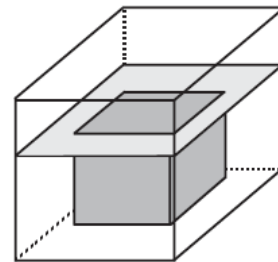
25

Q is the point of intersection of the diagonals of one face of a cube whose edges have length 2 units. The length of QR is
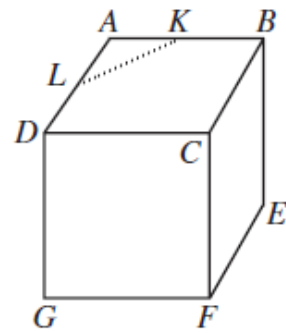
(A) 2　　　　(B) $\sqrt{8}$　　　　(C) $\sqrt{5}$

(D) $\sqrt{12}$　　　　(E) $\sqrt{6}$

26

In the cube shown, L and K are midpoints of adjacent edges AD and AB. The perpendicular distance from F to the line segment LK is 10. What is the volume of the cube, to the nearest integer?
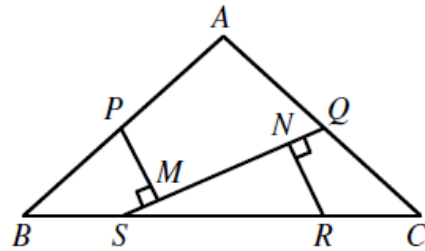
(A) 323   (B) 324   (C) 325

(D) 326   (E) 327

27

$\triangle ABC$ is an isosceles triangle in which $AB = AC = 10$ and $BC = 12$. The points S and R are on BC such that $BS:SR:RC = 1:2:1$. The midpoints of AB and AC are P and Q respectively. Perpendiculars are drawn from P and R to SQ meeting at M and N respectively. The length of MN is
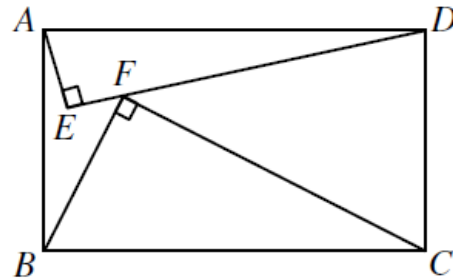
(A) $\dfrac{9}{\sqrt{13}}$ (B) $\dfrac{10}{\sqrt{13}}$ (C) $\dfrac{11}{\sqrt{13}}$

(D) $\dfrac{12}{\sqrt{13}}$ (E) $\dfrac{5}{2}$

28

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

29

In the diagram, the right prism has quadrilateral base $EFGH$ with right angles at E and G. The height AE is 32. The distance from A to G is

(A) 41   (B) 40   (C) 34

(D) 36   (E) 44