

PART A Mathematics

1 Evaluate

$$\frac{(\sqrt{12} + \sqrt{3})^2}{(\sqrt{12} - \sqrt{3})^2}$$

A 1

B 3

C $\frac{5}{3}$

D $\frac{7}{3}$

E $3\sqrt{3}$

F 9

2 Solve fully the inequality

$$2x^2 \geq 15 - x$$

A $x \leq -3$

B $x \geq 2.5$

C $x \leq -1.5, x \geq 5$

D $-1.5 \leq x \leq 5$

E $x \leq -3, x \geq 2.5$

F $-3 \leq x \leq 2.5$

- 3** The equation gives y in terms of x :

$$y = 3\left(\frac{x}{2} - 1\right)^2 - 5$$

Which one of the following is a rearrangement for x in terms of y ?

- A** $x = 2 \pm 2\sqrt{\frac{y-5}{3}}$
- B** $x = 2 \pm 2\sqrt{\frac{y+5}{3}}$
- C** $x = 2 \pm 3\sqrt{\frac{y+5}{3}}$
- D** $x = -2 \pm 2\sqrt{\frac{y+5}{3}}$
- E** $x = -2 \pm 3\sqrt{\frac{y+5}{2}}$
- F** $x = 2 + 2\left(\frac{y+5}{3}\right)^2$
- G** $x = -2 + 2\left(\frac{y+5}{3}\right)^2$

- 4 A fruit stall sells apples costing £ x each, and pears costing £ y each.

Sam bought 2 apples and 5 pears, and the total cost of these was £ P .

Lesley bought 3 apples and 2 pears, and the total cost of these was £ Q .

Which of the following is an expression for the cost, in pounds (£), of a pear?

A $\frac{2Q - 3P}{3}$

B $\frac{2Q - 3P}{11}$

C $\frac{Q - P}{3}$

D $\frac{Q - P}{11}$

E $\frac{P - Q}{3}$

F $\frac{3P - 2Q}{3}$

G $\frac{3P - 2Q}{11}$

- 5 P is directly proportional to Q squared.

When P is 2, Q is 4.

Q is inversely proportional to R .

When Q is 2, R is 5.

What is P in terms of R ?

A $P = \frac{5}{R}$

B $P = \frac{5}{4R}$

C $P = \frac{1}{800R^2}$

D $P = \frac{5}{4R^2}$

E $P = \frac{25}{2R^2}$

F $P = \frac{800}{R^2}$

G $P = \frac{R^2}{50}$

H $P = \frac{25R^2}{2}$

- 6 Two sequences are defined by the following rules:

In sequence S the n^{th} term is $7n + 1$

In sequence T the n^{th} term is $99 - n^2$

What is the smallest value of n for which the n^{th} term of sequence S is greater than the n^{th} term of sequence T ?

- A 6
- B 7
- C 8
- D 13
- E 14
- F 15

- 7 Which one of the following is a simplification of

$$2 - \frac{x^2(9x^2 - 4)}{x^3(2 - 3x)}$$

- A $-1 - \frac{2}{x}$
- B $-1 + \frac{2}{x}$
- C $5 - \frac{2}{x}$
- D $5 + \frac{2}{x}$
- E $5 - \frac{3}{x}$
- F $5 + \frac{3}{x}$

- 8 The parallelogram $OPQR$, labelled clockwise, is in the first quadrant ($x \geq 0$, $y \geq 0$) with O at the origin.

The point R has coordinates $\left(\frac{3a}{2}, 0\right)$ and the point Q has coordinates $(2a, a+1)$.

The area of $OPQR$ is 9 square units.

What are the coordinates of point P ?

- A $\left(\frac{\sqrt{3}}{2}, 1+\sqrt{3}\right)$
- B $(1, 3)$
- C $(1.5, 4)$
- D $(2, 3)$
- E $(3, 4)$
- F $(2\sqrt{3}, 1+\sqrt{3})$

- 9 What is the value of x that makes the following expression correct?

$$2^{3+2x} 4^x 8^{-x} = 4\sqrt{2}$$

- A -2.25
- B -1.75
- C -1.5
- D -0.5
- E -0.25

- 10** There are 100 students in Year 10.

Each student studies exactly one of French, German, and Spanish.

X girls study French and there are $3X$ girls in total.

$2Y$ boys study German.

There are 35 students studying Spanish of which Y are boys.

Which of the following is an expression for the total number of students studying German?

- A** $X + 2Y$
- B** $X + Y + 35$
- C** $X + 3Y - 35$
- D** $2X + 2Y$
- E** $2X + Y - 35$
- F** $2X + 3Y - 35$
- G** $2X + Y + 35$

- 11** An exterior angle of a regular polygon with n sides is 4° larger than an exterior angle of a regular polygon with $(n + 3)$ sides.

What is the value of n ?

- A** 10
- B** 12
- C** 15
- D** 18
- E** 21
- F** 24
- G** 27

- 12** The bearing of a ship R from a lighthouse L is 220°

A canoe C is due North of R .

C is the same distance from the ship and the lighthouse.

What is the bearing of L from C ?

- A** 070°
- B** 080°
- C** 090°
- D** 100°
- E** 140°

- 13** The hands of a 12-hour analogue clock move continuously. When the time on the clock is 4:00, the angle between the minute hand and the hour hand is 120° .

What is the angle between the two hands at 4:40?

- A** 80°
- B** 100°
- C** 110°
- D** 120°
- E** 140°

- 14** The cost of manufacturing a cake is directly proportional to the volume of the cake.

The baker makes a 70% profit when he sells a large rectangular cake.

The baker sells a large rectangular cake for £6.80

The baker decides to sell smaller rectangular cakes. The length, width, and height of the smaller cakes are all half of those of the large rectangular cake.

He sells a pack of 6 of the smaller cakes for £6.50

How much profit does he make on the pack of smaller cakes?

- A** £0.50
- B** £2.93
- C** £3.00
- D** £3.50
- E** £4.97

- 15** A pet shop has 4 female rabbits and x male rabbits for sale.

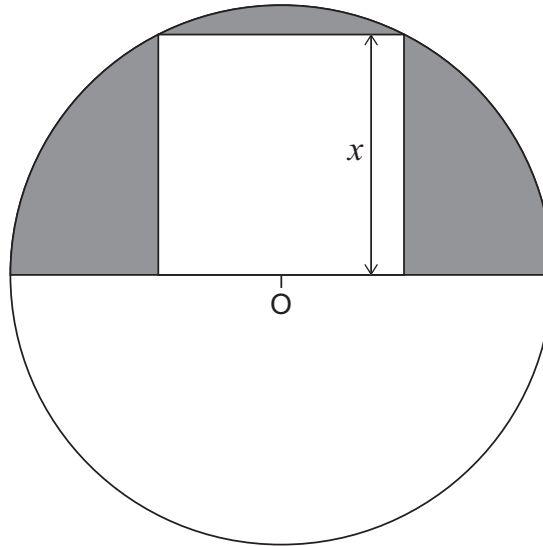
A customer buys 2 of the rabbits, chosen at random, and each rabbit is equally likely to be chosen.

The probability that both the chosen rabbits are male is $\frac{1}{3}$.

What is the value of x ?

- A** 2
- B** 4
- C** 6
- D** 8
- E** 9
- F** 11
- G** 12

16



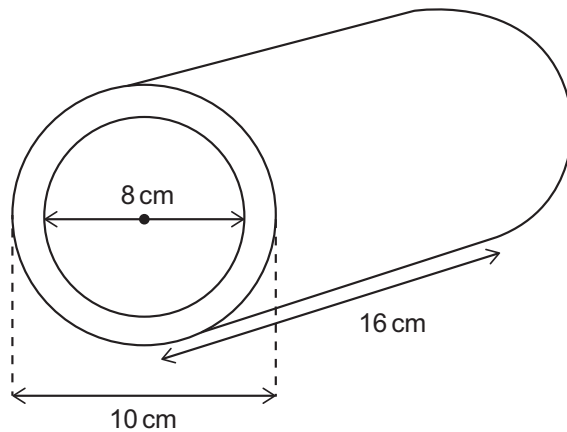
The diagram shows a square with side of length x cm. A circle is drawn with centre O which lies at the mid-point of one of the sides of the square. This side forms part of a diameter of the circle. The circle passes through two corners of the square as shown.

What is the area, in cm^2 , of the shaded part of the semi-circle?

- A** $(\pi - 1)x^2$
- B** $\left(\frac{\pi - 2}{2}\right)x^2$
- C** $\left(\frac{3\pi - 2}{2}\right)x^2$
- D** $\left(\frac{3\pi - 4}{4}\right)x^2$
- E** $\left(\frac{5\pi - 4}{4}\right)x^2$
- F** $\left(\frac{5\pi - 8}{8}\right)x^2$

- 17** A cylindrical hollow metal pipe is 16 cm long.
It has an external diameter of 10 cm and an internal diameter of 8 cm.
The density of the metal from which the pipe is made is 8 grams per cm^3 .

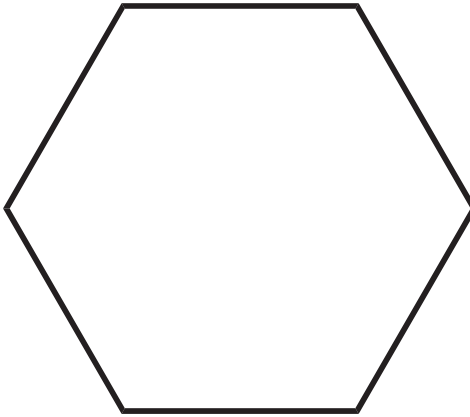
[diagram not to scale]



What is the mass of the pipe in grams?

- A** 8π
- B** 16π
- C** 18π
- D** 72π
- E** 128π
- F** 512π
- G** 1152π
- H** 4608π

- 18 The shortest distance between two opposite sides of a regular hexagon is 12 cm.



Find the area, in cm^2 , of the regular hexagon.

- A $36\sqrt{3}$
- B 72
- C $54\sqrt{3}$
- D 108
- E $72\sqrt{3}$
- F 144
- G $144\sqrt{3}$
- H $288\sqrt{3}$