

PART A Mathematics

- 1 The admission charge to a cinema is different for adults and children.

Admission for 2 adults and 3 children costs £20.

Admission for 4 adults and 4 children costs £34.

What does admission cost for 6 adults and 2 children?

- A £27
- B £29
- C £33
- D £39
- E £44
- F £48
- G £72

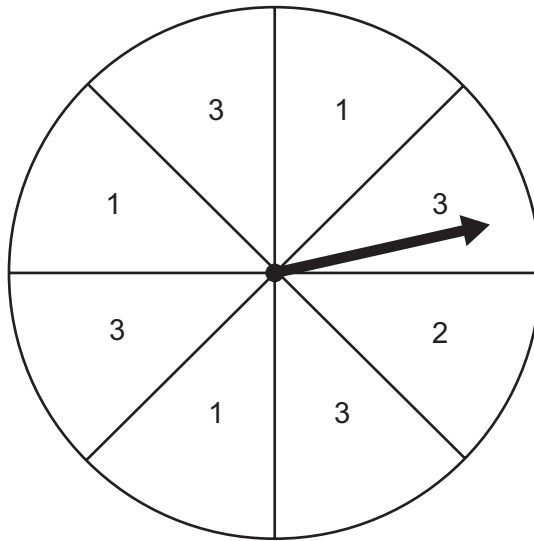
- 2 The n^{th} term of a sequence is $2n - 5$.

Which row in the table is correct for this sequence?

	<i>term-to-term rule</i>	<i>term which has a value of 17</i>
A	subtract 5	11^{th}
B	subtract 5	29^{th}
C	subtract 2	11^{th}
D	subtract 2	29^{th}
E	add 5	11^{th}
F	add 5	29^{th}
G	add 2	11^{th}
H	add 2	29^{th}

- 3 A fair spinner has eight equal sections.

Each section has one number written on it, as shown.

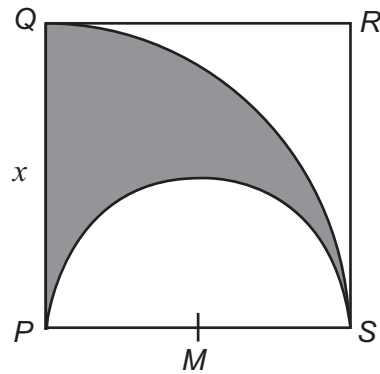


The spinner is spun twice, and the two numbers scored are added.

What is the probability that the sum of the two numbers is 5?

- A $\frac{1}{8}$
B $\frac{5}{8}$
C $\frac{1}{16}$
D $\frac{3}{16}$
E $\frac{25}{64}$
F $\frac{55}{64}$

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$PQRS$ is a square with side length x .

M is the midpoint of side PS .

A circular arc, with centre M , is drawn inside the square from S to P .

Another circular arc, with centre P , is drawn inside the square from S to Q .

What is the area of the shaded region in terms of x ?

- A** $\frac{1}{8}\pi x^2$
- B** $\frac{3}{16}\pi x^2$
- C** $\frac{1}{4}\pi x^2$
- D** $\frac{5}{16}\pi x^2$
- E** $\frac{3}{8}\pi x^2$
- F** $\frac{7}{16}\pi x^2$
- G** $\frac{1}{2}\pi x^2$

- 5** A balloon contains 5000cm^3 of gas.

The gas in the balloon gradually escapes so that the volume of the balloon decreases.

60% of the volume of the balloon is lost each week.

What is the volume of the balloon, in cm^3 , after 3 weeks?

- A** 0
- B** 128
- C** 320
- D** 800
- E** 1080

- 6** Consider the four lines with the following equations.

1 $2x + 6y = 3$

2 $9y = 3x - 4$

3 $2y = 6x + 3$

4 $4x + 6y - 9 = 0$

Which two lines are perpendicular?

- A** 1 and 2
- B** 1 and 3
- C** 1 and 4
- D** 2 and 3
- E** 2 and 4
- F** 3 and 4

- 7 The equilateral triangle PQR has sides of length 8 cm.

A circle, centre O , passes through each of the vertices of the triangle.

Find an expression for the circumference of the circle, in cm.

A $\frac{\sin 60^\circ}{8\pi}$

B $\frac{8\pi}{\sin 60^\circ}$

C $\frac{\cos 60^\circ}{8\pi}$

D $\frac{8\pi}{\cos 60^\circ}$

E $\frac{\tan 60^\circ}{8\pi}$

F $\frac{8\pi}{\tan 60^\circ}$

- 8 Find the sum of the solutions of

$$2\left(\frac{x}{4}+3\right)^2 - \left(\frac{x}{4}+3\right) - 36 = 0$$

A 2

B $\frac{3}{2}$

C $\frac{1}{2}$

D -4

E -13

F -22

G -26

H -34

- 9 When the expression

$$(2x + 3)^2 - (x - 3)^2$$

is written in the form $p(x + q)^2 + r$, where p , q and r are constants, what is the value of r ?

- A -27
- B -9
- C 0
- D 3
- E 15

- 10 Which one of the following expressions is equivalent to

$$\frac{a}{b/c} - \frac{a/b}{c}$$

- A 0
- B $\frac{a(b^2 - 1)}{bc}$
- C $\frac{a(b^2 - c^2)}{bc}$
- D $\frac{a^2b^2 - c^2}{abc}$
- E $\frac{a(c^2 - 1)}{bc}$
- F $\frac{a^2c^2 - b^2}{abc}$
- G $\frac{b^2 - a^2}{abc}$

- 11 The table shows statistics relating to the test marks of two groups of students.

	<i>number of students</i>	<i>mean</i>	<i>range</i>
<i>group X</i>	10	36	16
<i>group Y</i>	20	48	21

The results for the two groups of students are combined.

What can be deduced about the mean and range of the combined results?

- A** mean = 40, range ≤ 16
- B** mean = 40, $16 < \text{range} < 21$
- C** mean = 40, range ≥ 21
- D** mean = 44, range ≤ 16
- E** mean = 44, $16 < \text{range} < 21$
- F** mean = 44, range ≥ 21
- 12 The number of pairs of winter boots sold on a day is inversely proportional to the cube of the outside temperature on that day, measured in $^{\circ}\text{C}$.
- On a day when the outside temperature is 8°C , 250 pairs of boots are sold.
- The next day, when the outside temperature is $x^{\circ}\text{C}$, the number of pairs of boots sold is 700% more than on the previous day.
- What is the value of x ?
- A** 2
- B** 4
- C** $\frac{8}{\sqrt[3]{7}}$
- D** $8\sqrt[3]{7}$
- E** 16

- 13** In a sale, all prices are reduced by 25%.

A customer calculates the pre-sale price of a bicycle incorrectly by increasing the marked sale price by 25%.

The customer's calculated pre-sale price is incorrect by £15.

What is the correct pre-sale price of the bicycle?

- A** £180
- B** £195
- C** £210
- D** £225
- E** £240

- 14** A paint colour is a mixture of red paint, blue paint and yellow paint.

The ratio of red paint to blue paint in the mixture is 18 : 5

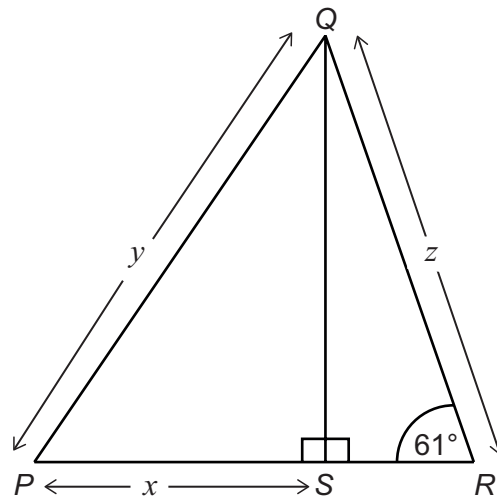
The ratio of blue paint to yellow paint in the mixture is $p : 3$

The ratio of red paint to yellow paint in the mixture is 12 : 5

What is the value of p ?

- A** 2
- B** 4.5
- C** 5
- D** 7.5
- E** 12

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[diagram not to scale]

In the diagram, QS is perpendicular to PR .

$$PS = x \text{ cm}$$

$$PQ = y \text{ cm}$$

$$QR = z \text{ cm}$$

$$\text{angle } QRS = 61^\circ$$

PSR is a straight line.

Which one of the following is an expression for the length z , in cm?

A $\sqrt{y^2 + x^2} \sin 61^\circ$

B $\sqrt{y^2 - x^2} \sin 61^\circ$

C $\sqrt{y^2 + x^2} \cos 61^\circ$

D $\sqrt{y^2 - x^2} \cos 61^\circ$

E $\frac{\sqrt{y^2 + x^2}}{\sin 61^\circ}$

F $\frac{\sqrt{y^2 - x^2}}{\sin 61^\circ}$

G $\frac{\sqrt{y^2 + x^2}}{\cos 61^\circ}$

H $\frac{\sqrt{y^2 - x^2}}{\cos 61^\circ}$

- 16** Two identical fair six-sided dice each have their faces numbered from 1 to 6, with one number on each face.

Both dice are thrown, and the number on each of the dice is recorded.

They are then both thrown again, and the number on each of the dice is recorded.

What is the probability that at least one of the four recorded numbers is even?

- A** $\frac{1}{4}$
- B** $\frac{1}{2}$
- C** $\frac{9}{16}$
- D** $\frac{3}{4}$
- E** $\frac{15}{16}$

- 17** The quadratic equation $2x^2 - px - 4 = 0$, where p is a positive constant, has two solutions that differ by 6.

What is the value of p ?

- A** 2
- B** $4\sqrt{7}$
- C** 12
- D** $4\sqrt{11}$
- E** $4\sqrt{34}$
- F** $6\sqrt{30}$

- 18** Two vertices of a square are at $(1, 1)$ and $(3, 5)$.

What is the difference between the perimeters of the largest and smallest possible squares that can be drawn with these points as two of their vertices?

A 0

B $4\sqrt{3}(2 - \sqrt{2})$

C $4\sqrt{3}(\sqrt{2} - 1)$

D $4\sqrt{5}(2 - \sqrt{2})$

E $4\sqrt{5}(\sqrt{2} - 1)$

F $4\sqrt{13}(2 - \sqrt{2})$

G $4\sqrt{13}(\sqrt{2} - 1)$

H $4\sqrt{3}\sqrt{5}(2 - \sqrt{2})$

- 19** The point M is $(2, 5)$ and the point N is $(-3, -1)$.

The line segment MN is transformed to the line segment TU by two transformations:

MN is rotated 90° clockwise about the origin to give the line segment RS .

RS is then translated by the vector $\begin{pmatrix} p \\ q \end{pmatrix}$ to give the line segment TU .

The coordinates of the midpoint of TU are $(7, -2.5)$.

Find the vector $\begin{pmatrix} p \\ q \end{pmatrix}$

A $\begin{pmatrix} 2 \\ 0.5 \end{pmatrix}$

B $\begin{pmatrix} 0.5 \\ 2 \end{pmatrix}$

C $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$

D $\begin{pmatrix} -3 \\ 5 \end{pmatrix}$

E $\begin{pmatrix} 9 \\ -2 \end{pmatrix}$

F $\begin{pmatrix} -2 \\ 9 \end{pmatrix}$

- 20** A solid cone has a base radius x cm.

The ratio of the perpendicular height of the cone to the radius of the cone is $5:2$

A solid hemisphere of radius $\frac{y}{2}$ cm is made from the same material as the cone.

Which one of the following is a correct expression for

$$\frac{\text{volume of the cone}}{\text{volume of the hemisphere}}$$

(Volume of a cone = $\frac{1}{3}\pi r^2 h$ where r is the radius and h is the perpendicular height.)

(Volume of a sphere = $\frac{4}{3}\pi r^3$ where r is the radius.)

A $\frac{5x^3}{y^3}$

B $\frac{5x^3}{4y^3}$

C $\frac{8x^3}{5y^3}$

D $\frac{10x^3}{y^3}$

E $\frac{14x^3}{y^3}$