

PART A Mathematics

1 Evaluate

$$(\sqrt{7} + \sqrt{3})^2 - (\sqrt{7} - \sqrt{3})^2$$

- A** 0
- B** $2\sqrt{7}$
- C** $4\sqrt{7}$
- D** $2\sqrt{21}$
- E** 10
- F** $4\sqrt{21}$
- G** 20

2 Find the complete set of values of x which satisfy the inequality

$$\frac{1}{2}(3x - 2) - \frac{2}{3}(x - 4) < x$$

- A** $x < -22$
- B** $x > -22$
- C** $x < -2.5$
- D** $x > -2.5$
- E** $x < 1.2$
- F** $x > 1.2$
- G** $x < 10$
- H** $x > 10$

- 3 The equation gives y in terms of x :

$$y = 3 - 4\left(1 - \frac{x}{2}\right)^2$$

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

A $x = -2 \pm 2\sqrt{\frac{3-y}{4}}$

B $x = -2 \pm 2\sqrt{\frac{4-y}{3}}$

C $x = 1 \pm \sqrt{\frac{3-y}{4}}$

D $x = 1 \pm 2\sqrt{\frac{3-y}{4}}$

E $x = 2 \pm 2\sqrt{\frac{3-y}{4}}$

F $x = 2 \pm 2\sqrt{\frac{4-y}{3}}$

G $x = 2 \pm 2\sqrt{\frac{3+y}{4}}$

- 4 The resistance to the motion of a car is directly proportional to the square of the speed of the car.

The car increases its speed by 20%.

What is the percentage increase in the resistance to the motion of the car?

A 20%

B 24%

C 44%

D 120%

E 224%

F 240%

G 400%

- 5 The equation of a curve is $y = px^2 + qx$ where p and q are constants.

The curve passes through the points $(2, 6)$ and $(4, -4)$.

What is the value of $q - p$?

- A 1
- B 2
- C 5
- D 6
- E 9
- F 16

- 6 Which of the following is a simplification of

$$4 - \frac{x(3x+1)}{x^2(3x^2-2x-1)}$$

- A $\frac{12x^3 - 8x^2 - 7x - 1}{x(3x-1)(x-1)}$
- B $\frac{4x^2 + 4x - 1}{x(x+1)}$
- C $\frac{4x^2 + 4x + 1}{x(x+1)}$
- D $\frac{4x^2 - 4x - 1}{x(x-1)}$
- E $\frac{4x^2 - 4x + 1}{x(x-1)}$
- F $\frac{12x^3 - 8x^2 - x + 1}{x(3x-1)(x-1)}$

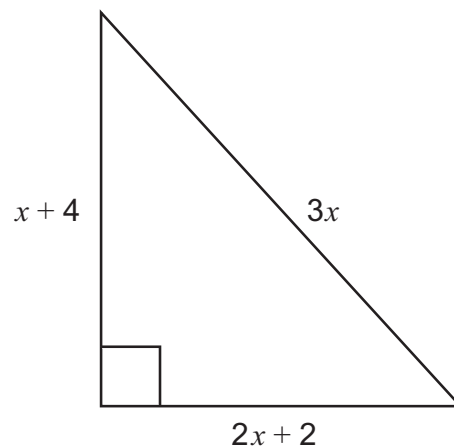
- 7 The ball for a garden game is a solid sphere of volume 192 cm^3 .

For the children's version of the game the ball is a solid sphere made of the same material, but the radius is reduced by 25%.

What is the volume, in cm^3 , of the children's ball?

- A 48
- B 81
- C 96
- D 108
- E 144

- 8 The diagram shows a right-angled triangle, with sides of length $x + 4$, $2x + 2$ and $3x$, all in cm.



[diagram not to scale]

What is the area, in cm^2 , of the triangle?

- A 10
- B 12
- C 28
- D 36
- E 40
- F 54
- G 70

- 9 Given that

$$9^{2x-1} \times \frac{1}{27^x} = 81^x$$

what is the value of x ?

- A $-\frac{2}{3}$
- B $-\frac{2}{5}$
- C $-\frac{1}{3}$
- D $-\frac{1}{4}$
- E $-\frac{1}{5}$

- 10 PR and QS are the diagonals of a rhombus $PQRS$.

$$PR = (3x + 2) \text{ cm}$$

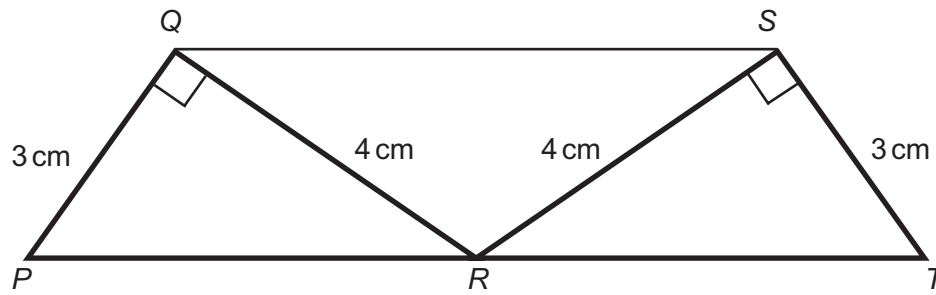
$$QS = (8 - 2x) \text{ cm}$$

The area of $PQRS$ is 11 cm^2 .

What is the difference, in cm, between the two possible lengths of PR ?

- A $2\frac{2}{3}$
- B $4\frac{1}{2}$
- C $5\frac{1}{3}$
- D 8
- E 14

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[diagram not to scale]

The diagram shows two congruent right-angled triangles PQR and TSR with right angles at Q and S , respectively.

$$PQ = TS = 3 \text{ cm}$$

$$QR = SR = 4 \text{ cm}$$

PRT is a straight line.

What is the length, in cm, of QS ?

- A 4
- B $3\sqrt{2}$
- C 5.2
- D $4\sqrt{2}$
- E 6.4
- F 8.2
- G 10

- 12** The total of three numbers p , q and r is 375

The ratio $p : q$ is 5 : 7

The ratio $q : r$ is 4 : 11

What is the value of $p + r$?

- A** 16
- B** 60
- C** 97
- D** 125
- E** 144
- F** 231
- G** 291
- H** 315

- 13** The straight line P has equation $3y - 2x = 12$ and intercepts the y -axis at the point $(0, p)$.

The straight line Q is parallel to P , passes through the point $(6, -1)$ and intercepts the y -axis at the point $(0, q)$.

What is the value of $p - q$?

- A** -9
- B** -7
- C** 1
- D** 9
- E** 14
- F** 17

- 14** The vertices of a rectangle have coordinates:

$$P(4, 5) \qquad Q(4, 8) \qquad R(10, 8) \qquad S(10, 5)$$

$PQRS$ is transformed by a clockwise rotation of 90° about P followed by a reflection in the x -axis.

What are the coordinates of the final position of R ?

- A** $(-8, -10)$
- B** $(-7, -1)$
- C** $(-4, 1)$
- D** $(-1, 11)$
- E** $(1, -11)$
- F** $(4, -1)$
- G** $(7, 1)$
- H** $(8, 10)$

- 15** Box A contains exactly 10 balls, of which 6 are red and 4 are blue.

Box B contains exactly 15 balls, of which 3 are red and 12 are blue.

All the balls are identical in every respect, apart from colour.

One of the two boxes is chosen at random by tossing two fair coins, as follows:

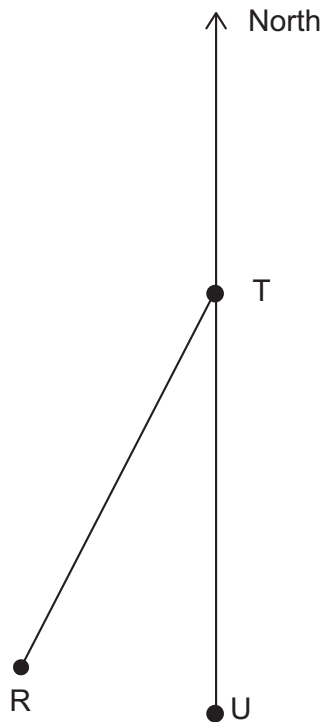
“If **both** coins show heads, box A is selected. Otherwise box B is selected.”

One ball is then randomly taken from the selected box.

What is the probability that a red ball is taken?

- A** $\frac{9}{400}$
- B** $\frac{3}{25}$
- C** $\frac{3}{10}$
- D** $\frac{2}{5}$
- E** $\frac{1}{2}$
- F** $\frac{4}{5}$
- G** $\frac{323}{400}$

- 16** Three towns Ryeton, Tonbridge and Uphampton are represented on the diagram by the points labelled R, T and U, respectively.



[diagram not to scale]

The distance from Tonbridge to Ryeton is the same as the distance from Tonbridge to Uphampton.

Uphampton is south of Tonbridge.

Ryeton is on a bearing of 210° from Tonbridge.

What is the bearing of Uphampton from Ryeton?

- A** 030°
- B** 075°
- C** 105°
- D** 150°
- E** 300°
- F** 345°

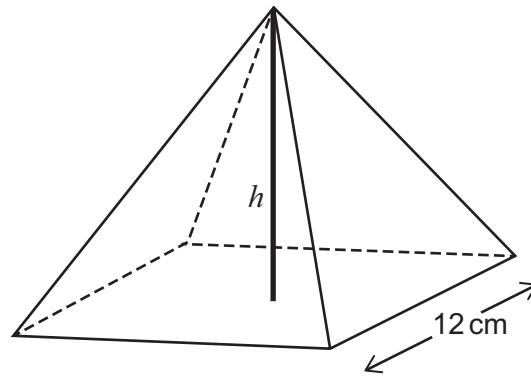
- 17 A list of five numbers has mean x , median y and range z .

A sixth number is added to the list. This sixth number is greater than x .

Which of the following statements **must** be true?

- 1 The median of the six numbers cannot be one of the numbers in the list.
 - 2 The mean of the six numbers is greater than x .
 - 3 The range of the six numbers is greater than z .
- A none of them
- B 1 only
- C 2 only
- D 3 only
- E 1 and 2 only
- F 1 and 3 only
- G 2 and 3 only
- H 1, 2 and 3

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[diagram not to scale]

A solid pyramid has a square base of side length 12 cm and a vertical height of h cm.

The volume of the pyramid, in cm^3 , is equal to the total surface area of the pyramid, in cm^2 .

What is the value of h ?

(volume of pyramid = $\frac{1}{3} \times \text{area of base} \times \text{vertical height}$)

- A $\frac{72}{35}$
- B $2\sqrt{3}$
- C 6
- D $\frac{144}{23}$
- E 8
- F $2\sqrt{21}$

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PART B Physics