

PART A Mathematics

- 1 Simplify fully

$$5xy^2 \times (5x^2y)^{-3} \times 5x^2y$$

where x and y are positive.

A $\frac{1}{125x^7y^2}$

B $\frac{1}{125x^6y^2}$

C $\frac{1}{25x^6y}$

D $\frac{1}{25x^4y}$

E $\frac{1}{5x^3}$

F $\frac{1}{5x^2}$

G $\frac{y}{x^2}$

H $5xy^2$

- 2 Which of the following is a simplification of

$$2 - \frac{x + 3x^2}{12x^2 + x - 1}$$

where $x > 1$?

A $\frac{7x - 1}{4x - 1}$

B $\frac{7x - 2}{4x - 1}$

C $\frac{7x + 1}{4x + 1}$

D $\frac{7x + 2}{4x + 1}$

E $\frac{9x - 1}{4x - 1}$

F $\frac{9x - 2}{4x - 1}$

G $\frac{9x + 1}{4x + 1}$

H $\frac{9x + 2}{4x + 1}$

- 3 Which of the following is a rearrangement of

$$\frac{p}{2} + \frac{3}{q} = \frac{4}{r}$$

so that q is the subject?

A $q = \frac{2r}{24 - 3pr}$

B $q = \frac{3r}{2r - p}$

C $q = \frac{6r}{4 - p}$

D $q = \frac{6r}{8 - pr}$

E $q = \frac{r - 2}{12p}$

F $q = \frac{3r - 6}{4p}$

G $q = \frac{pr - 8}{12p}$

H $q = \frac{3pr - 24}{4p}$

- 4 A circle has its centre at $(0, 0)$.

What is the equation of the tangent that touches the circle at the point $(4, 3)$?

A $3y + 4x = 25$

B $3y - 4x = 25$

C $3y - 4x = -7$

D $3y - 4x = 7$

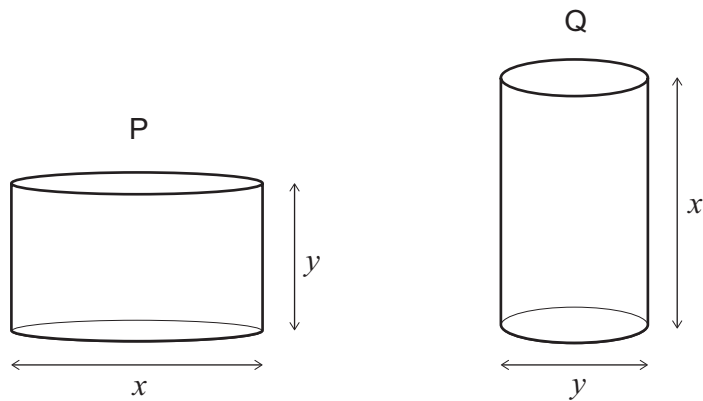
E $4y + 3x = 24$

F $4y - 3x = 24$

G $3y + 4x = 24$

H $3y - 4x = 24$

- 5 Two solid cylinders, P and Q, are shown, where $x > y$.



Cylinder P has diameter x and height y .

Cylinder Q has diameter y and height x .

What is the positive difference between the total surface areas of P and Q?

- A 0
- B $\frac{\pi}{4}(x^2 - y^2)$
- C $\frac{\pi}{2}(x^2 - y^2)$
- D $\pi(x^2 - y^2)$
- E $2\pi(x^2 - y^2)$
- F $\frac{\pi}{4}xy(x - y)$
- G $\pi xy(x - y)$

- 6 Given that

$$8^x + 27^x = \frac{13}{36}$$

$$8^x - 27^x = \frac{5}{36}$$

what is the value of x ?

- A** -4
- B** -3
- C** -2
- D** $-\frac{3}{2}$
- E** $-\frac{2}{3}$
- F** $-\frac{1}{2}$
- G** $-\frac{1}{3}$
- H** $-\frac{1}{4}$
- 7 The price of item P is reduced by 10%. The next day, the new price is increased by 10%.
The price of item Q is increased by 10%. The next day, the new price is reduced by 10%.
How does the final price of each item compare to the original price of that item?

	<i>item P final price</i>	<i>item Q final price</i>
A	lower than original	lower than original
B	lower than original	higher than original
C	higher than original	lower than original
D	higher than original	higher than original
E	the same as original	the same as original

- 8 Here is a pattern of numbers:

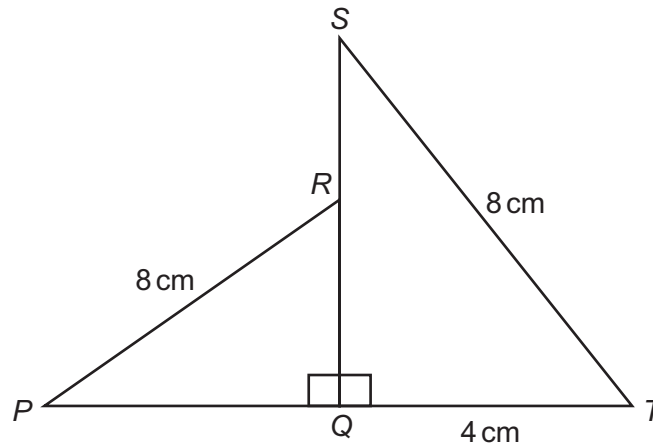
1						
2	3	4				
5	6	7	8	9		
10	11	12	13	14	15	16

The pattern of numbers is continued in the same way.

What number will appear directly below 196?

- A 218
- B 219
- C 220
- D 221
- E 222
- F 223
- G 224
- H 225

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[diagram not to scale]

SQT is a right-angled triangle with the right angle at Q .

The point R is on SQ such that $SR:RQ = 1:3$

QRP is a right-angled triangle with the right angle at Q .

$PR = ST = 8\text{ cm}$

$QT = 4\text{ cm}$

What is the length of PQ , in cm?

- A $2\sqrt{3}$
- B $4\sqrt{3}$
- C $\sqrt{19}$
- D $\sqrt{37}$
- E $\sqrt{55}$
- F $\sqrt{61}$

- 10** Pat and Alex have a combined total of £63.

The ratio of Pat's money to Alex's money is 5 : 2

They each spend an equal amount on sweets.

The ratio of Pat's money to Alex's money is now 3 : 1

How much did Pat spend on sweets?

- A** £0.50
- B** £2.00
- C** £2.25
- D** £3.00
- E** £4.50
- F** £6.75

- 11** The curve with equation $y = x^2 - 4x + 5$ meets the straight line with equation $y = 2x + c$ at two points, which have x -coordinates p and q , where $q > p$.

Given that $q - p = 8$, what is the value of the constant c ?

- A** -43
- B** -12
- C** -2
- D** 0
- E** 2
- F** 12
- G** 43

- 12 An online company sells storage containers.

The following items are available:

<i>capacity of container</i>	<i>number available</i>
2 litres	2
3 litres	3
7 litres	4
8 litres	1

A customer orders two containers at random from those available.

What is the probability that the two containers will have a combined capacity of exactly 10 litres?

- A $\frac{7}{25}$
B $\frac{14}{25}$
C $\frac{7}{45}$
D $\frac{14}{45}$
E $\frac{7}{50}$

13 Given that

$$y = \frac{\sin 60^\circ - 1}{\cos 60^\circ}$$

what is the value of y^3 ?

A $-\frac{\sqrt{3}}{9}$

B $-5\sqrt{2} + 10$

C $3\sqrt{3} - 8$

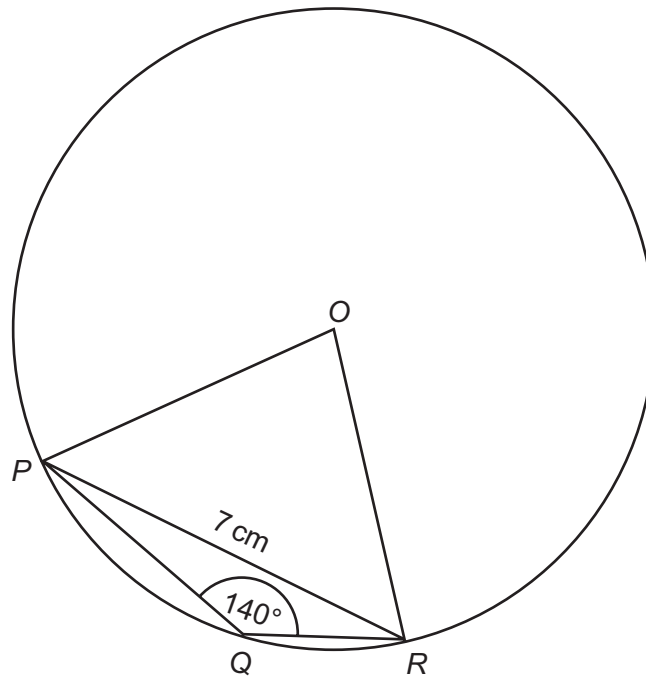
D $6\sqrt{3} - 10$

E $14\sqrt{2} - 20$

F $15\sqrt{3} - 26$

G $21\sqrt{3} - 38$

- 14 P , Q and R are points on the circumference of a circle with centre O as shown in the diagram.



[diagram not to scale]

Angle $PQR = 140^\circ$

$PR = 7$ cm

Which of the following expressions gives the radius of the circle, in cm?

- A $7 \sin 10^\circ$
- B $3.5 \sin 55^\circ$
- C $3.5 \sin 70^\circ$
- D $7 \sin 55^\circ$
- E $\frac{3.5}{\sin 40^\circ}$
- F $\frac{7}{\sin 80^\circ}$
- G $\frac{3.5}{\sin 20^\circ}$
- H $\frac{7}{\sin 40^\circ}$

- 15** Charlie has a bowl containing red sweets and green sweets only. The sweets are identical in all respects except colour.

There are nine sweets in total in the bowl.

Charlie eats two sweets from the bowl at random.

The probability of Charlie not eating any green sweets is $\frac{5}{12}$

What is the probability that Charlie eats two green sweets?

A $\frac{2}{27}$

B $\frac{1}{12}$

C $\frac{1}{9}$

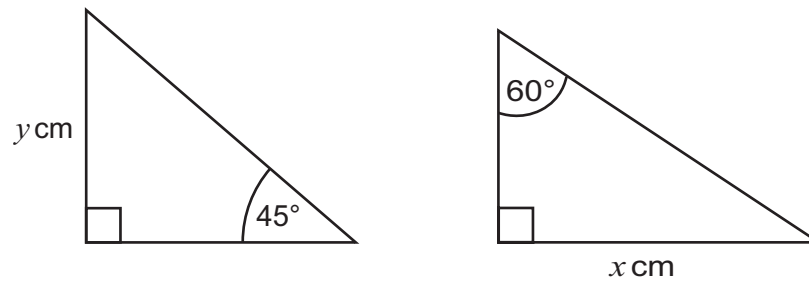
D $\frac{4}{27}$

E $\frac{1}{6}$

F $\frac{1}{4}$

G $\frac{7}{12}$

- 16 The following right-angled triangles have the same hypotenuse length.

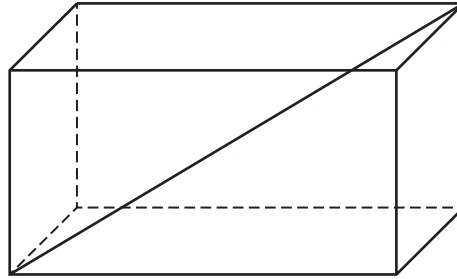


[diagram not to scale]

Which of the following is a correct expression for y in terms of x ?

- A $y = \sqrt{2}x$
- B $y = \frac{\sqrt{2}x}{2}$
- C $y = \frac{\sqrt{2}x}{3}$
- D $y = \frac{\sqrt{2}x}{6}$
- E $y = \sqrt{6}x$
- F $y = \frac{\sqrt{6}x}{2}$
- G $y = \frac{\sqrt{6}x}{3}$
- H $y = \frac{\sqrt{6}x}{6}$

- 17 The greatest diagonal distance between the two vertices of a cuboid, as shown in the diagram, is $\sqrt{77}$ cm.



A similar cuboid has all its lengths exactly half the lengths of the original cuboid.

The sides of this smaller cuboid are 2 cm, 3 cm and x cm.

What is the value of x , in cm?

- A $\frac{5}{2}$
- B 5
- C $\frac{5\sqrt{2}}{2}$
- D $5\sqrt{2}$
- E $\frac{\sqrt{102}}{2}$
- F $\sqrt{102}$

- 18** Alex, Cameron and Sam are all taking part in a 400 m race.

They are each running at a different constant speed.

Alex is running 12% faster than Cameron, whilst Sam is running 2% slower than Cameron.

When Alex crosses the finish line, how many metres is Sam from the finish line?

- A** 9.6
- B** 14
- C** 24
- D** 25
- E** 28
- F** 50
- G** 56

- 19** A car journey is m miles long.

One kilometre is equivalent to x miles.

The car uses one litre of fuel to travel a distance of f kilometres.

Fuel for the car costs p pence per litre.

Which of the following expressions gives the cost of fuel for this journey, in pounds?

(There are 100 pence in one pound.)

A $100fmpx$

B $\frac{100fmp}{x}$

C $\frac{100mpx}{f}$

D $\frac{100mp}{fx}$

E $\frac{fmpx}{100}$

F $\frac{fmp}{100x}$

G $\frac{mpx}{100f}$

H $\frac{mp}{100fx}$

20 How many solutions are there to the equation

$$\tan x = 100x$$

where $-360 \leq x \leq 360$?

- A** 0
- B** 1
- C** 2
- D** 3
- E** 4
- F** 5
- G** infinitely many