AQA Paper 2H Practice Booklet

20 practice questions based on the advance information

Copies of this booklet, as well as hints & solutions, are available at bossmaths.com/advanceinfo

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Question 1

An antique vase was worth £8400 on January 1st 2019.
By January 1st 2020, it had increased in value by 8.5%.
By January 1st 2021, however, its value fell by a fifth.

Circle all the calculations that give the correct value, in pounds, of the vase on January 1st 2021.

$8400 \times 0.085 \times \frac{1}{5}$ $\qquad$ $8400 \times \frac{108.5}{100} \times 0.2$ $\qquad$ $8400 \times 1.085 \times 0.8$

$8400 \times 1.085 \times \frac{1}{5}$ $\qquad$ $8400 \times 1.085 \times \frac{4}{5}$ $\qquad$ $\frac{8400}{100} \times 108.5 \times \frac{4}{5}$

Question 2

$\left(x^{-\frac{8}{3}}\right)^{\frac{5}{4}} \equiv \frac{1}{\sqrt[3]{x^k}}$, where k is some constant.

Find the value of k.

$$\left(x^{-\frac{8}{3}}\right)^{\frac{5}{4}} \equiv x^{\frac{-40}{12}} \equiv x^{\frac{-10}{3}} \equiv \frac{1}{\sqrt[3]{x^{10}}}$$

So $\underline{k = 10}$

Question 3

(a) Here are five powers of 17:

17^1 17^{20} 17^{60} 17^{80} 17^{93}

Fill in each blank using one of the above powers of 17:

17^1 .... is prime.

17^{60} .... is both a square and a cube number.

17^{93} .... is a cube number but not a square number.

(b) Here are six numbers:

5^4 4^5 $4^{\frac{1}{5}}$ $(-4)^5$ 4^{-5} $\frac{5}{4}$

Fill in each blank using one of the above six numbers.

4^5 .... and 4^{-5} .... are reciprocals of each other.

4^5 .... and $(-4)^5$ .... sum to 0.

Question 4

(a) Factorise $17x^2 + 2x - 19$

$$\underline{(17x + 19)(x - 1)}$$

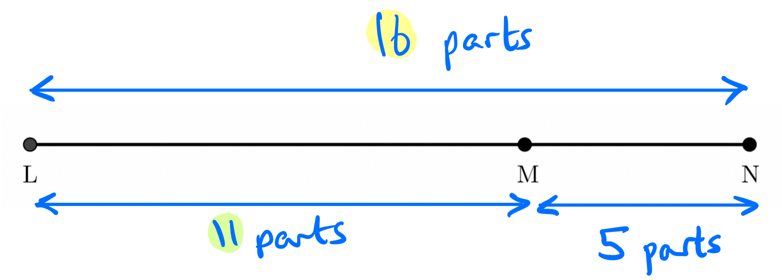
(b) Expand and simplify $(8t + 3)(8t - 3)$

$$64t^2 + 24t - 24t - 9$$

$$\equiv \underline{64t^2 - 9}$$

Question 5

L, M and N lie on a straight line. The ratio of the distances LN:LM is 16:11



LN is 64 km. Find the distance MN.

Parts	Distance
16	64 km
1	4 km
5	20 km

MN is $\underline{\text{20 km}}$

Question 6

This formula can be used to find the nth triangular number:

$$n\text{th triangular number } = \frac{1}{2}n(n+1)$$

Find the mean of the 75th, 76th, and 77th triangular numbers.

Notice:

75th triangular number = $\frac{1}{2} \times 75 \times 76$ = 2850

76th triangular number = $\frac{1}{2} \times 76 \times 77$ = 2926

77th triangular number = $\frac{1}{2} \times 77 \times 78$ = 3003

$2850 \xrightarrow{+76} 2926 \xrightarrow{+77} 3003$

$$\text{Mean} = \frac{2850 + 2926 + 3003}{3} = 2926\tfrac{1}{3}$$

Question 7

A swimming pool holds 2,500,000 litres of water.

A pump can drain the pool at a rate of 7.6 litres of water per second.

How long will it take to pump 20% of the water out of the pool?
Give your answer in hours and minutes, correct to the nearest minute.

20% of 2,500,000 ℓ = 500,000 ℓ.

$$\frac{500{,}000 \text{ ℓ}}{7.6 \text{ ℓ/s}} = 65{,}789 \text{ seconds}$$

$= 1096.49\ldots$ minutes (rounds to 1096)

18 hours 16 minutes

Question 8

A force of x newtons initially acts on an area of 15 cm^2.

The force is increased by 20% while the area is reduced until the pressure has doubled.

By how much is the area reduced?

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Initial pressure $= \dfrac{x}{15}$ N/cm²

Later pressure $= \dfrac{1.2x}{\text{new area}}$ N/cm² $=$ 2x initial pressure

$$\Rightarrow \quad \frac{1.2x}{\text{new area}} = \frac{2x}{15}$$

×0.6

×0.6

So new area = 9 cm²

i.e. <u>a reduction of 6 cm²</u>

6 .... cm²

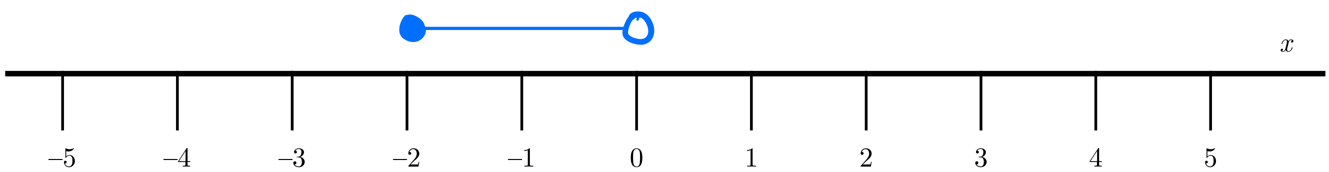
Question 9

(a) Solve $3 < -2x + 3 \leq 7$

$0 < -2x \leq 4$

$0 > x \geq -2$

(b) Show the solutions to the inequality on the number line.



Question 10

$p = 0.30$ correct to 2 decimal places
$q = 1.2$ correct to 1 decimal place

Work out the upper bound for $q - p$

	UB	LB
p	0.305	0.295
q	1.25	1.15

Upper bound for $q - p$

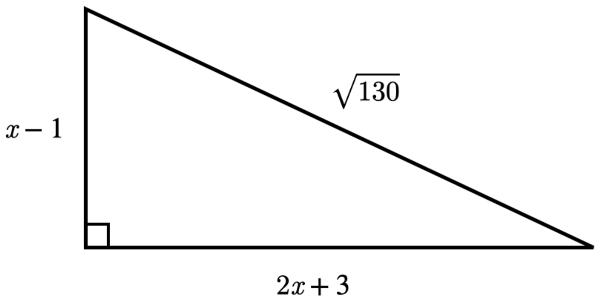
= upper bound for q − lower bound for p

$= 1.25 - 0.295$

$= \underline{0.955}$

Question 11

The diagram shows the lengths, in centimetres, of the sides of a right-angled triangle.
Find the value of x.



Pythagoras' theorem $\Rightarrow$ $(2x+3)^2 + (x-1)^2 = (\sqrt{130})^2$

$$\Rightarrow \quad 4x^2 + 12x + 9 + x^2 - 2x + 1 = 130$$

$$\Rightarrow \quad 5x^2 + 10x + 10 = 130$$

$$\Rightarrow \quad 5x^2 + 10x - 120 = 0$$

$$\Rightarrow \quad x^2 + 2x - 24 = 0$$

$$\Rightarrow \quad (x+6)(x-4) = 0$$

This has two solutions: $x = -6$, $x = 4$

If $x = -6$, then $x-1$ and $2x+3$ are negative, which doesn't make sense in this context.

So $x = 4$

Question 12

A biased coin is flipped 215 times. It comes up heads 145 times and it comes up tails 70 times.

The coin is continues to be flipped until it has been flipped a total of 860 times. Altogether, how many times would you expect the coin to come up tails?

$$\frac{70}{215} \times 860 = \underline{280 \text{ times}}$$

Question 13

(a) Without expanding any brackets, show how to work out the exact solutions of $25\left(x - \frac{4}{5}\right)^2 - 16 = 0$

$$25\left(x - \frac{4}{5}\right)^2 = 16$$

$$\left(x - \frac{4}{5}\right)^2 = \frac{16}{25}$$

$$x - \frac{4}{5} = \pm\frac{4}{5}$$

$$x = 0, \quad x = -\frac{8}{5}$$

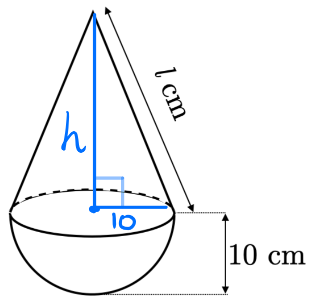
(b) A curve has equation $y = 25\left(x - \frac{4}{5}\right)^2 - 16$

Write down the coordinates of the turning point of this curve.

$$\left(\frac{4}{5}, -16\right)$$

Question 14

A hemisphere of radius 10 cm and a cone are attached to form solid A. The circular base of the cone perfectly fits onto the circular face of the hemisphere.



Solid A has a volume of 1200π cm³.

(a) Find l, the slant height of the cone.
Round your answer to 3 significant figures.

Volume of hemisphere $= \frac{2}{3}\pi r^3 = \frac{2000\pi}{3}$ cm^3

Volume of cone $= \frac{1}{3}\pi r^2 h = \frac{100\pi h}{3}$ cm^3

So $\frac{2000\pi}{3} + \frac{100\pi h}{3} = 1200\pi$

$\Rightarrow 2000\cancel{\pi} + 100h\cancel{\pi} = 3600\cancel{\pi}$

$\Rightarrow h = 16$ cm

Using Pythagoras, $l = \sqrt{10^2 + 16^2} = \underline{18.9 \text{ cm}}$ to 3s.f.

(b) Solid B is mathematically similar to solid A. The hemisphere and the base of the cone that make up solid B each have a radius of 5 cm. Work out the ratio of the of surface area of solid A to the surface area of solid B, writing your answer in the form $1 : n$.

$A \rightarrow B$ Length scale factor $= \frac{1}{2}$

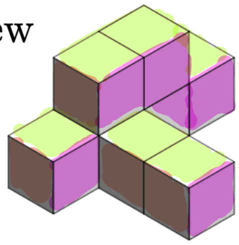
Area scale factor $= \left(\frac{1}{2}\right)^2 = \frac{1}{4}$

The ratio is therefore $\underline{1 : \frac{1}{4}}$

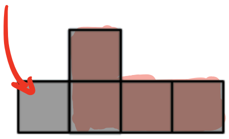
Question 15

This solid is made out of several identical cubes. Four views of the solid are shown.

3D view

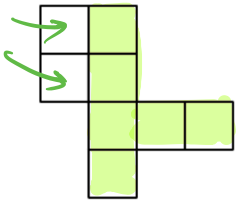


Not visible in 3D view

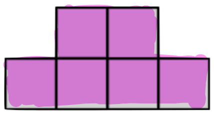


Front elevation

Not visible in 3D view



Plan view



Side elevation

Work out how many cubes the solid is made of.

10 cubes

Question 16

$ABEF$, $BCDE$, and $ACDF$ are parallelograms. The diagram shows $\angle FAD = 80°$ and $\angle BED = 48°$.

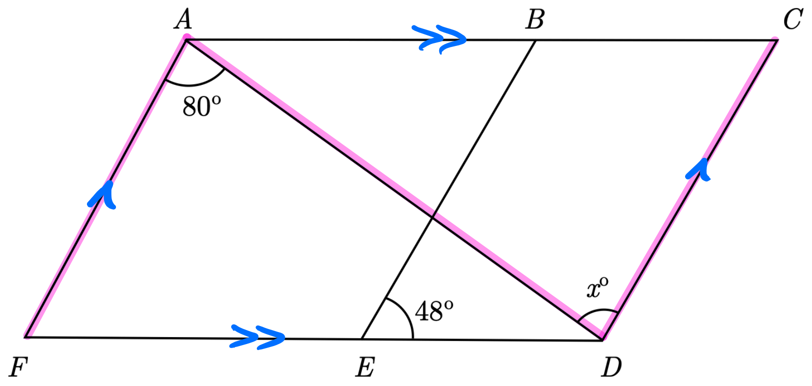


DIAGRAM NOT ACCURATELY DRAWN

Find the value of x.

$x = 80$ $\angle ADC$ and $\angle FAD$ are alternate.

Question 17

Before an event, a caterer asks a sample of 50 guests what type of meal they would prefer. This table shows the results:

Preferred meal	Number of people
Chicken	23
Fish	9
Vegetarian	15
Vegan	3

The caterer uses these results to work out how many of each meal to make for an event with 620 guests. Where the number of meals calculated for a particular option is not a whole number, the caterer rounds up the number of meals to the next whole number.

How many vegan meals should the caterer prepare?
Write down any assumptions you make about the caterer's sample.

$\frac{3}{50}$ of the sample want a vegan meal

$\frac{3}{50}$ of 620 = 37.2

Round up to 38 vegan meals

Assumption: the sample is representative of the full guest population.

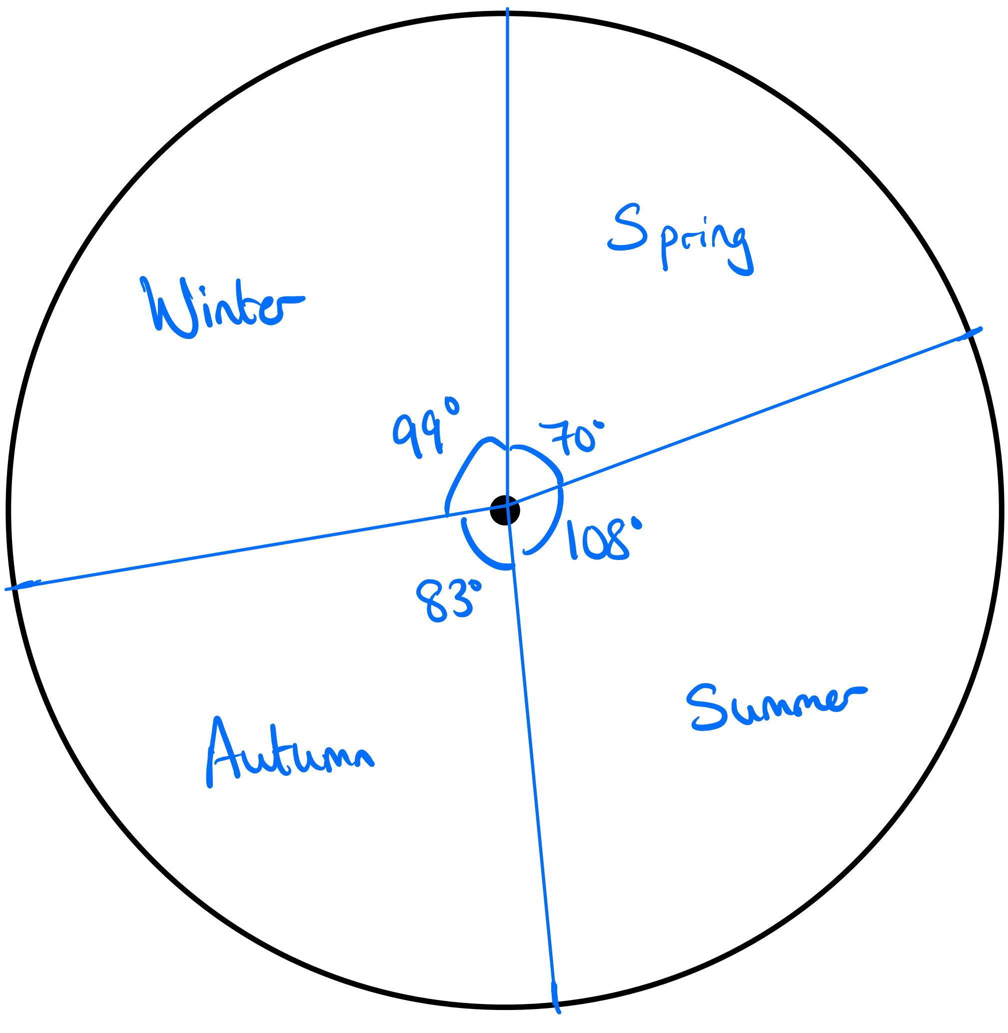
Question 18

This table shows the total sales made in a clothes shop during each season. Complete the table and construct a pie to show this information. Round your angles to the nearest degree.

Season	Value of sales	Angle
Spring	£93,000	70°
Summer	£144,000	108°
Autumn	£111,000	83°
Winter	£132,000	99°
Total	£480,000	360°

$\frac{93000}{144000}$ or $\frac{93}{144}$ of 360°

etc.



Question 19

$\mathrm{f}(x) = \dfrac{x+3}{7}$ and $\mathrm{g}(x) = px + 5$ where p is a constant.

Given that $\mathrm{g}(3) = 11$, solve $\mathrm{f}^{-1}(x) = \mathrm{g}(x)$

Find p

$$g(3) = 3p + 5 = 11$$

$$\Rightarrow \quad p = \frac{11-5}{3} = 2 \qquad \text{so} \quad g(x) = 2x + 5$$

Find $f^{-1}(x)$

$$f(x) = \frac{x+3}{7} \quad \Rightarrow \quad f(f^{-1}(x)) = \frac{f^{-1}(x)+3}{7}$$

$$\Rightarrow \quad x = \frac{f^{-1}(x)+3}{7}$$

$$\Rightarrow \quad 7x - 3 = f^{-1}(x)$$

Solve $f^{-1}(x) = g(x)$

$$7x - 3 = 2x + 5$$

$$\Rightarrow \quad 5x = 8$$

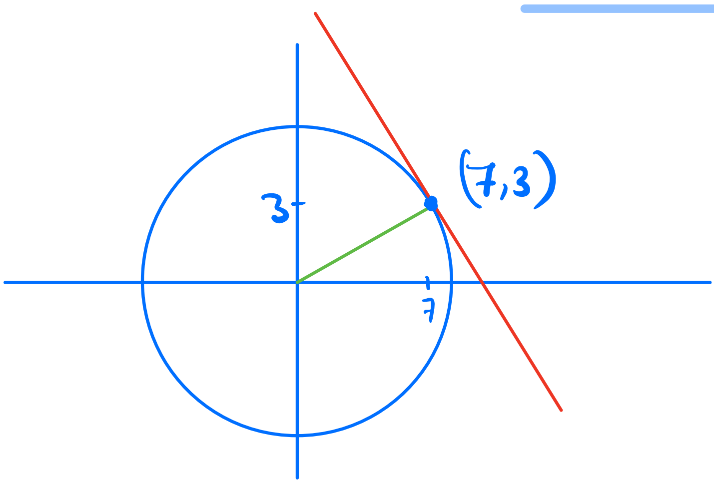
$$\Rightarrow \quad x = \frac{8}{5} \text{ or } 1.6$$

Question 20

(a) The point A has coordinates $(7, 3)$. Given that A lies on the circle with equation $x^2 + y^2 = k$, find the value of k.

$$7^2 + 3^2 = k$$

$$\Rightarrow 49 + 9 = k \quad \Rightarrow k = 58$$



(b) Find the equation of the tangent to the circle at A, giving your answer in the form $y = mx + c$

The tangent is perpendicular to the radius at (7,3)

The radius has gradient $\frac{3}{7}$

$\therefore$ the tangent has gradient $-\frac{7}{3}$

$$y - 3 = -\frac{7}{3}(x - 7) = -\frac{7}{3}x + \frac{49}{3}$$

$$\Rightarrow y - \frac{9}{3} = -\frac{7}{3}x + \frac{49}{3} \Rightarrow y = -\frac{7}{3}x + \frac{58}{3}$$