

'Build A Mathematician' Task

S3

PATHWAY TO
NATIONAL 5

Phase Test Revision



Express the following in simplest form:

a) $\sqrt{8}$ b) $\sqrt{12}$ c) $\sqrt{20}$ d) $\sqrt{24}$

e) $\sqrt{72}$ f) $\sqrt{27}$ g) $\sqrt{32}$

Calculate:

a) $\sqrt{12} + \sqrt{27}$ b) $\sqrt{32} - \sqrt{8}$

c) $\sqrt{24} + \sqrt{54}$ d) $\sqrt{80} + \sqrt{20}$

Calculate:

a) $\sqrt{5} \times \sqrt{5}$ b) $\sqrt{3} \times \sqrt{6}$

c) $\sqrt{2} \times \sqrt{8}$ d) $\sqrt{8} \div \sqrt{2}$

e) $\sqrt{27} \div \sqrt{12}$ f) $\sqrt{3} \div \sqrt{27}$

Express the following with a *rational denominator*:

a) $\frac{1}{\sqrt{2}}$ b) $\frac{10}{\sqrt{5}}$

c) $\frac{2}{\sqrt{3}}$ d) $\frac{3}{\sqrt{5}}$

e) $\frac{1}{2\sqrt{5}}$

EXPANDING BRACKETS

Expand:

a) $6(5b - 5)$

b) $3(5m + 5)$

c) $5(2y - 9)$

d) $9(9x - 4)$

e) $7(7e + 7)$

f) $7(3b + 3) + 3(6b + 2)$

g) $6(9q + 3) + 8(8q + 7)$

h) $4(3w + 4) - 8(3 - 4w)$

i) $7(6u + 4) - 9(7u + 4)$

Calculate:

a) $9g(7g - 3)$

b) $6r(3r - 2)$

c) $3c(5c - 8)$

d) $3r(7r - 7)$

e) $5b(3b - 5)$

f) $-2t(3t + 5)$

Calculate:

a) $(x + 7)(x + 5)$

b) $(x + 10)(x + 6)$

c) $(x + 8)^2$

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

e) $(x - 5)(x - 6)$

f) $(x - 7)^2$

g) $(2x + 2)(2x - 4)$

h) $(4x - 3)(2x - 1)$

STATISTICS

A sample of pupils were given a French vocabulary test and their results recorded.

The results were as follows: 6 3 7 9 5 4 5 7 8 6

- (a) Calculate the mean test score.
- (b) Calculate the range.

Each pupils was then given time to revise before sitting a similar vocabulary test.

In the second test, then mean was 8 and the range was 4.

- (c) Write two comments comparing the results in the first test compared to the results in the second test.

A short survey recorded the ages of the first 8 people to enter a library on a Monday morning at 9am.

The results, in years, are shown below: 25 58 78 50 57 64 40 4

- (a) Calculate the mean age of visitors.
- (b) Calculate the range of ages.

A second survey was taken of the first 8 people to enter the same library at 8pm on the same day.

In the second survey, the mean was 36 and the range was 20.

- (c) Write two comments comparing the results in the first survey compared to the results in the second survey.

A sample of students was asked how many times each had visited the cinema in the last three months.

The results are shown below.

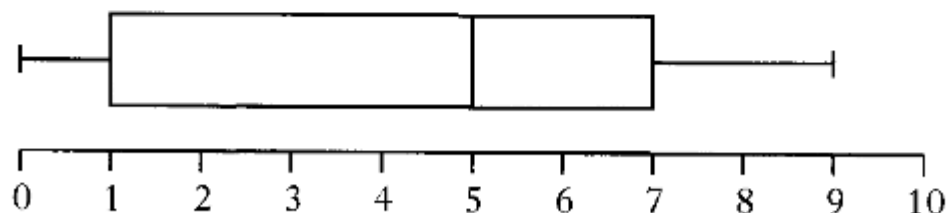
4	5	4	1	4	3	2	2	4	6	2
3	4	4	1	3	1	2	3	1	1	

(a) From the above data, find the median, the lower quartile and the upper quartile. 3

(b) Construct a boxplot for the data. 2

(c) The same sample of students was asked how many times each had attended a football match in the same three months.

The boxplot below was drawn for this data.



Compare the two boxplots and comment.

1

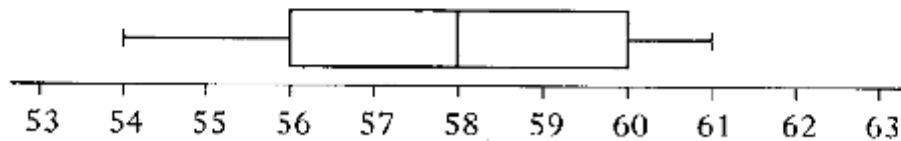
A manufacturer of matches claims that there are "on average 60 matches per box".

MTAF

A sample of eleven boxes contains the following numbers of matches per box.

58, 62, 60, 65, 59, 60, 59, 62, 61, 61, 64

- (a) From the above data, find the median, the lower quartile and the upper quartile. 2
- (b) Comment on the claim made above. 1
- (c) Construct a boxplot for the data. 2
- (d) A different sample of matchboxes was taken.
The boxplot, shown below, was drawn for the new data.



Does this new data support the manufacturer's claim?

Give a reason for your answer.

1

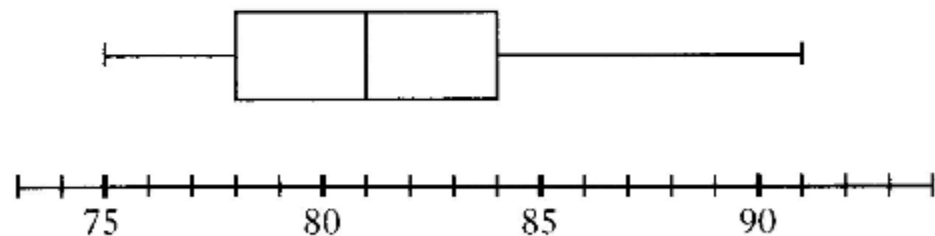
For a group of freezers in a shop, the volume, in litres, of each one is listed below.

78 81 91 75 85 83 84 78

(a) For the given data, calculate:

- | | |
|---------------------------|---|
| (i) the median; | 1 |
| (ii) the lower quartile; | 1 |
| (iii) the upper quartile. | 1 |

One of the numbers from the above list was accidentally missed out. A boxplot was then drawn and is shown below.



(b) Which number was missed out?

Give a reason for your answer.

2

S3 Phase Test Revision

$$\begin{aligned} \text{Q1 a) } & \sqrt{8} \\ & = \sqrt{4} \times \sqrt{2} \\ & = \underline{\underline{2\sqrt{2}}} \end{aligned}$$

$$\begin{aligned} \text{b) } & \sqrt{12} \\ & = \sqrt{4} \times \sqrt{3} \\ & = \underline{\underline{2\sqrt{3}}} \end{aligned}$$

$$\begin{aligned} \text{c) } & \sqrt{20} \\ & = \sqrt{4} \times \sqrt{5} \\ & = \underline{\underline{2\sqrt{5}}} \end{aligned}$$

$$\begin{aligned} \text{d) } & \sqrt{24} \\ & = \sqrt{4} \times \sqrt{6} \\ & = \underline{\underline{2\sqrt{6}}} \end{aligned}$$

$$\begin{aligned} \text{e) } & \sqrt{72} \\ & = \sqrt{36} \times \sqrt{2} \\ & = \underline{\underline{6\sqrt{2}}} \end{aligned}$$

$$\begin{aligned} \text{f) } & \sqrt{27} \\ & = \sqrt{9} \times \sqrt{3} \\ & = \underline{\underline{3\sqrt{3}}} \end{aligned}$$

$$\begin{aligned} \text{g) } & \sqrt{32} \\ & = \sqrt{16} \times \sqrt{2} \\ & = \underline{\underline{4\sqrt{2}}} \end{aligned}$$

$$\begin{aligned} \text{Q2 a) } & \sqrt{12} + \sqrt{27} \\ & = 2\sqrt{3} + 3\sqrt{3} \\ & = \underline{\underline{5\sqrt{3}}} \end{aligned}$$

$$\begin{aligned} \text{... } & \sqrt{12} \\ & = \sqrt{4} \times \sqrt{3} \\ & = 2\sqrt{3} \end{aligned}$$

$$\begin{aligned} & \sqrt{27} \\ & = \sqrt{9} \times \sqrt{3} \\ & = 3\sqrt{3} \end{aligned}$$

$$\begin{aligned} \text{b) } & \sqrt{32} - \sqrt{8} \\ & = 4\sqrt{2} - 2\sqrt{2} \\ & = \underline{\underline{2\sqrt{2}}} \end{aligned}$$

$$\begin{aligned} \text{... } & \sqrt{32} \\ & = \sqrt{16} \times \sqrt{2} \\ & = 4\sqrt{2} \end{aligned}$$

$$\begin{aligned} & \sqrt{8} \\ & = \sqrt{4} \times \sqrt{2} \\ & = 2\sqrt{2} \end{aligned}$$

$$\begin{aligned} \text{c) } & \sqrt{24} + \sqrt{54} \\ & = 2\sqrt{6} + 3\sqrt{6} \\ & = \underline{\underline{5\sqrt{6}}} \end{aligned}$$

$$\begin{aligned} \text{... } & \sqrt{24} \\ & = \sqrt{4} \times \sqrt{6} \\ & = 2\sqrt{6} \end{aligned}$$

$$\begin{aligned} & \sqrt{54} \\ & = \sqrt{9} \times \sqrt{6} \\ & = 3\sqrt{6} \end{aligned}$$

$$\begin{aligned}
 d) \quad & \sqrt{80} + \sqrt{20} \\
 & = 4\sqrt{5} + 2\sqrt{5} \\
 & = \underline{\underline{6\sqrt{5}}}
 \end{aligned}$$

$$\begin{aligned}
 \dots \text{ } \sqrt{80} &= \sqrt{16} \times \sqrt{5} = 4\sqrt{5} \\
 \sqrt{20} &= \sqrt{4} \times \sqrt{5} = 2\sqrt{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{Q3 a) } & \sqrt{5} \times \sqrt{5} \\
 & = \underline{\underline{5}} \quad (\text{since } \sqrt{25})
 \end{aligned}$$

$$\begin{aligned}
 b) \quad & \sqrt{3} \times \sqrt{6} \\
 & = \sqrt{18} \\
 & = \underline{\underline{3\sqrt{2}}}
 \end{aligned}$$

$$\begin{aligned}
 \dots \text{ } \sqrt{18} &= \sqrt{9} \times \sqrt{2} \\
 &= 3\sqrt{2}
 \end{aligned}$$

$$\begin{aligned}
 c) \quad & \sqrt{2} \times \sqrt{8} \\
 & = \sqrt{16} \\
 & = \underline{\underline{4}}
 \end{aligned}$$

$$\begin{aligned}
 \dots \text{ } \sqrt{16} & \Rightarrow \text{square number...}
 \end{aligned}$$

$$\begin{aligned}
 d) \quad & \sqrt{8} \div \sqrt{2} \\
 & = \sqrt{4} \\
 & = 2
 \end{aligned}$$

$$\begin{aligned}
 \dots \text{ } \sqrt{4} & \Rightarrow \text{square number.}
 \end{aligned}$$

$$\begin{aligned}
 e) \quad & \sqrt{27} \div \sqrt{12} \\
 & = \sqrt{\frac{27}{12}} \\
 & = \sqrt{\frac{9}{4}} \\
 & = \underline{\underline{\frac{3}{2}}}
 \end{aligned}$$

$$\begin{aligned}
 \dots \text{ } \frac{27}{12} \div 3 &= \frac{9}{4} \quad \text{simplify the fraction.}
 \end{aligned}$$

$$\sqrt{9} = 3$$

$$\sqrt{4} = 2$$

$$f) \sqrt{3} \div \sqrt{27}$$

$$= \sqrt{\frac{3}{27}}$$

$$= \sqrt{\frac{1}{9}}$$

$$= \underline{\underline{\frac{1}{3}}}$$

$$\text{∞} \quad \frac{3}{27} \div \frac{3}{9} \quad \frac{1}{9}$$

$$\sqrt{1} = 1$$

$$\sqrt{9} = 3$$

$$Q4 \quad \frac{1}{\sqrt{2}} \times \sqrt{2} = \underline{\underline{\frac{\sqrt{2}}{2}}}$$

$$b) \frac{10}{\sqrt{5}} \times \sqrt{5} = \frac{10\sqrt{5}}{5} = \underline{\underline{2\sqrt{5}}}$$

$$\text{∞} \quad 10 \div 5 = 2$$

$$c) \frac{2}{\sqrt{3}} \times \sqrt{3} = \underline{\underline{\frac{2\sqrt{3}}{3}}}$$

$$d) \frac{3}{\sqrt{5}} \times \sqrt{5} = \underline{\underline{\frac{3\sqrt{5}}{5}}}$$

$$e) \frac{1}{2\sqrt{5}} \times \sqrt{5} = \frac{\sqrt{5}}{2 \times 5} = \underline{\underline{\frac{\sqrt{5}}{10}}}$$

Expanding Brackets

$$\begin{aligned} \text{Q1 } & 6(5b-5) \\ & = \underline{\underline{30b-30}} \end{aligned}$$

$$\begin{aligned} \text{b) } & 3(5m+5) \\ & = \underline{\underline{15m+15}} \end{aligned}$$

$$\begin{aligned} \text{c) } & 5(2y-9) \\ & = \underline{\underline{10y-45}} \end{aligned}$$

$$\begin{aligned} \text{d) } & 9(9x-4) \\ & = \underline{\underline{81x-36}} \end{aligned}$$

$$\begin{aligned} \text{e) } & 7(7e+7) \\ & = \underline{\underline{49e+49}} \end{aligned}$$

$$\begin{aligned} \text{f) } & 7(3b+3) + 3(6b+2) \\ & = 21b+21 + 18b+6 \\ & = \underline{\underline{39b+27}} \end{aligned}$$

$$\begin{aligned} \text{g) } & 6(9q+3) + 8(8q+7) \\ & = 54q+18 + 64q+56 \\ & = \underline{\underline{118q+74}} \end{aligned}$$

$$\begin{aligned} \text{h) } & 4(3w+4) - 8(3-4w) \\ & = 12w+16 - 24 + 32w \\ & = \underline{\underline{44w-8}} \end{aligned}$$

$$\begin{aligned} \text{i) } & 7(6u+4) - 9(7u+4) \\ & = 42u+28 - 63u-36 \\ & = \underline{\underline{-21u-8}} \end{aligned}$$

$$\begin{aligned} \text{Q2} \quad & 9g(7g-3) \\ & = \underline{\underline{63g^2 - 27g}} \end{aligned}$$

$$\begin{aligned} \text{b)} \quad & 6r(3r-2) \\ & = \underline{\underline{18r^2 - 12r}} \end{aligned}$$

$$\begin{aligned} \text{c)} \quad & 3c(5c-8) \\ & = \underline{\underline{15c^2 - 24c}} \end{aligned}$$

$$\begin{aligned} \text{d)} \quad & 3r(7r-7) \\ & = \underline{\underline{21r^2 - 21r}} \end{aligned}$$

$$\begin{aligned} \text{e)} \quad & 5b(3b-5) \\ & = \underline{\underline{15b^2 - 25b}} \end{aligned}$$

$$\begin{aligned} \text{f)} \quad & -2t(3t+5) \\ & = \underline{\underline{-6t^2 - 10t}} \end{aligned}$$

$$\begin{aligned} \text{Q3} \quad & (x+7)(x+5) \\ & = x^2 + 5x + 7x + 35 \\ & = \underline{\underline{x^2 + 12x + 35}} \end{aligned}$$

$$\begin{aligned} \text{b)} \quad & (x+10)(x+6) \\ & = x^2 + 6x + 10x + 60 \\ & = \underline{\underline{x^2 + 16x + 60}} \end{aligned}$$

$$\begin{aligned} \text{c)} \quad & (x+8)^2 \\ & = (x+8)(x+8) \\ & = x^2 + 8x + 8x + 64 \\ & = \underline{\underline{x^2 + 16x + 64}} \end{aligned}$$

$$\begin{aligned} \text{d)} \quad & (x+3)(x-2) \\ & = x^2 - 2x + 3x - 6 \\ & = \underline{\underline{x^2 + x - 6}} \end{aligned}$$

$$\begin{aligned} \text{e)} \quad & (x-5)(x-6) \\ & = x^2 - 6x - 5x + 30 \\ & = \underline{\underline{x^2 - 11x + 30}} \end{aligned}$$

$$\begin{aligned} \text{f)} \quad & (x-7)^2 \\ & = (x-7)(x-7) \\ & = x^2 - 7x - 7x + 49 \\ & = \underline{\underline{x^2 - 14x + 49}} \end{aligned}$$

$$\begin{aligned} \text{g)} \quad & (2x+2)(2x-4) \\ & = 4x^2 - 8x + 4x - 8 \\ & = \underline{\underline{4x^2 - 4x - 8}} \end{aligned}$$

$$\begin{aligned} \text{h)} \quad & (4x-3)(2x-1) \\ & = 8x^2 - 4x - 6x + 3 \\ & = \underline{\underline{8x^2 - 10x + 3}} \end{aligned}$$

Statistics

Q1

$$\begin{aligned} \text{mean} &= \text{total} \div \text{number} \\ &= 60 \div 10 \\ &= \underline{\underline{6}} \end{aligned}$$

$$\begin{aligned} \text{range} &= \text{higher} - \text{lower} \\ &= 9 - 3 \\ &= \underline{\underline{6}} \end{aligned}$$

c)

mean	(a/b)
	6
range	6

(c)

8

4

you must start with "On average".
On average the score improved in the second test.
The scores in the second test were less spread out.

Q2

$$\begin{aligned} \text{mean} &= \text{total} \div \text{number} \\ &= 376 \div 8 \\ &= \underline{\underline{47}} \end{aligned}$$

$$\begin{aligned} \text{range} &= \text{higher} - \text{lower} \\ &= 78 - 4 \\ &= \underline{\underline{74}} \end{aligned}$$

c)

mean	(a/b)
	47
range	74

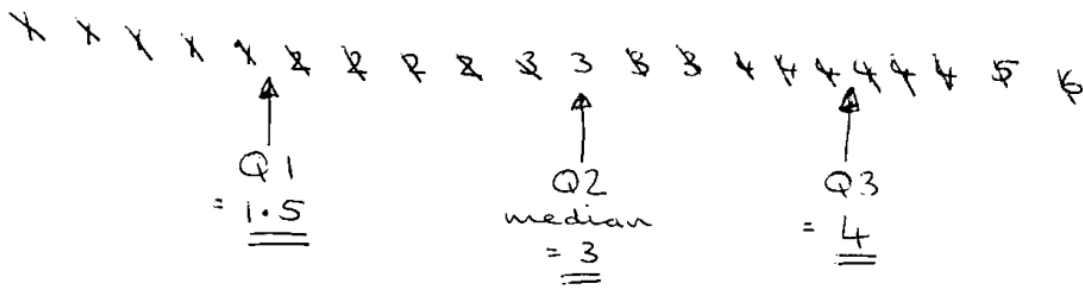
(c)

36

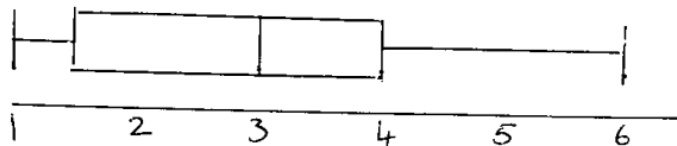
20

On average the age was less in the second survey.
The ages recorded in the second survey were less spread out.

Q3



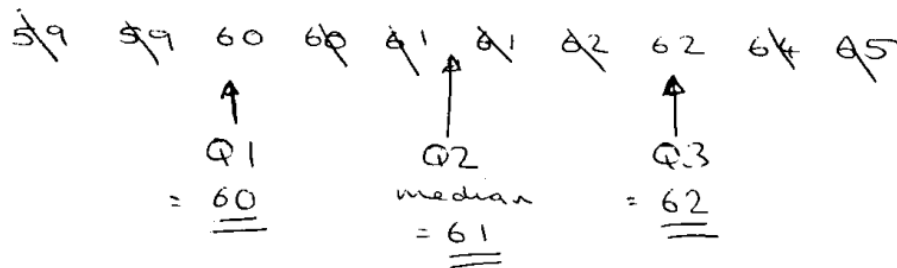
(b)



(c)

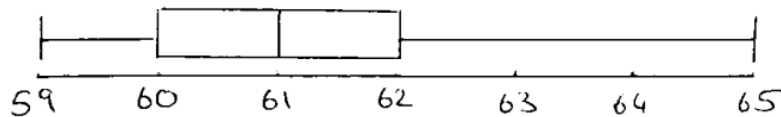
On average more students attend football matches. The number of times students attended football matches was more spread out than for that of the cinema.

Q4



(b) The claim said "on average 60 matches per box". However since the median represents the average the sample of boxes has a higher average (61).

(c)



(d) The new sample shows an average of 58 matches per box so it does not support the claim of 60.

Q5

75	78	78	81	83	84	85	91
	↑		↑		↑		
	Q1		Q2		Q3		
	= <u>78</u>		median		= <u>84.5</u>		
			= <u>82</u>				

b) 85 was missed out :


75	(78)	78	81	83	(84)	91
↑	↑		↑		↑	↑
Lowest	Q1		Q2		Q3	Highest


GO THE EXTRA MILE....




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 should be straightforward

 maybe a little tricky

 the hardest type

