4N WA1 (2022-2024) Revision

Mathematical Formulae

Compound Interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

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

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

Arc length = $r\theta$, where θ is in radians

$$\text{Sector area} = \frac{1}{2}r^2\theta \text{ , where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

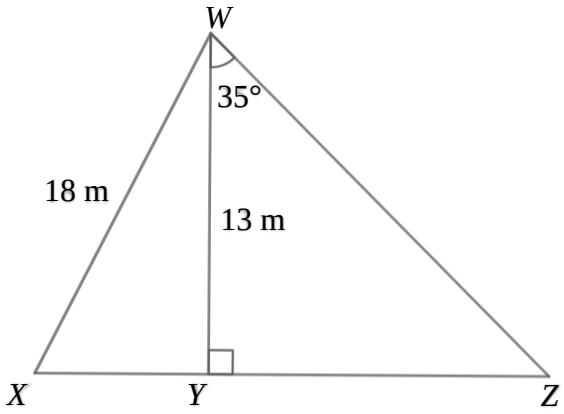
Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Extracted from 4NA WA1 2024

1



X, *Y* and *Z* are three points lying in a horizontal straight line.
WY is a vertical flagpole.
WX and *WZ* are supporting wires.
WX = 18 m, *WY* = 13 m and angle *YWZ* = 35°.

(a) Calculate *WZ*

$\cos 35° = \frac{13}{WZ}$

$WZ = \frac{13}{\cos 35°}$

$= 15.9°$

Answer ..... m [2]

(b) Benny said the angle of elevation of *W* from *X* is 43.8°.
Was Benny correct? Explain your answer
Answer [2]

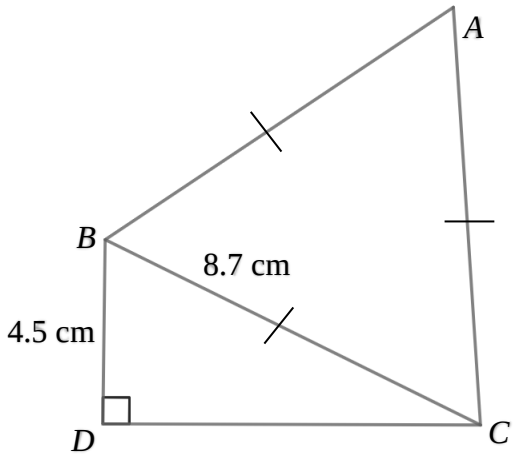
$\sin \angle WXY = \frac{13}{18}$

$\angle WXY = \sin^{-1}(\frac{13}{18})$

$= 46.2°$

Benny was wrong as the angle of elevation should be angle *WXY* and it is 46.2°

2



ABC is an equilateral triangle.
Angle *BDC* = 90° , *BD* = 4.5 cm and *BC* = 8.7 cm.

Calculate

(a) the length of *DC*,

$DC = \sqrt{8.7^2 - 4.5^2}$
= 7.446
= 7.45

Answer *DC* = …… cm [2]

(b) the area of the quadrilateral *ABDC*.

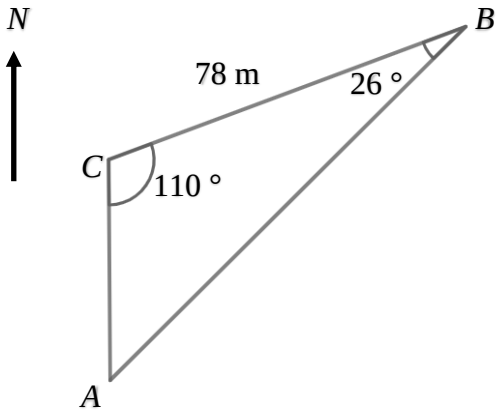
Area of
$\Delta BCD = \frac{1}{2} \times 4.5 \times 7.446 = 16.7535$

Area of
$\Delta ABC = \frac{1}{2} \times 8.7 \times 8.7 \times \sin 60 = 32.775$

Area of quad *ABCD* =
16.7535 + 32.775
= 49.5

Answer …… cm^2 [4]

3



A, *B* and *C* are on level horizontal ground.
BC = 78 m, angle *ACB* = 110° and angle *ABC* = 26°. *C* is due north of *A*.

(a) Calculate the bearing of *B* from *C*.

070°

Answer ……..... [1]

(b) Calculate the bearing of *A* from *B*.

angle N_1BC = 110° (alt angles , // lines)

bearing = 360° - 110 ° - 26 (angles at a pt)
= 224°

Answer ……..... [2]

(c) Calculate the length of *AC*.

$$\frac{AC}{\sin 26°} = \frac{78}{\sin 44°}$$

$$AC = \frac{78}{\sin 44°} \times \sin 26°$$

AC = 49.2

Answer ……m [3]

Extracted from 4NA WA 2023

4 Harry claims that the following three numbers could be the lengths of a right-angled triangle.

$$55 \ , \ 73 \ , \ 48$$

Justify, with clear working, whether his claim is true.

$48^2 = 2304$; $55^2 = 3025$; $73^2 = 5329$
Since $48^2 + 55^2 = 73^2$,
the 3 numbers are lengths of a right-angled triangle.

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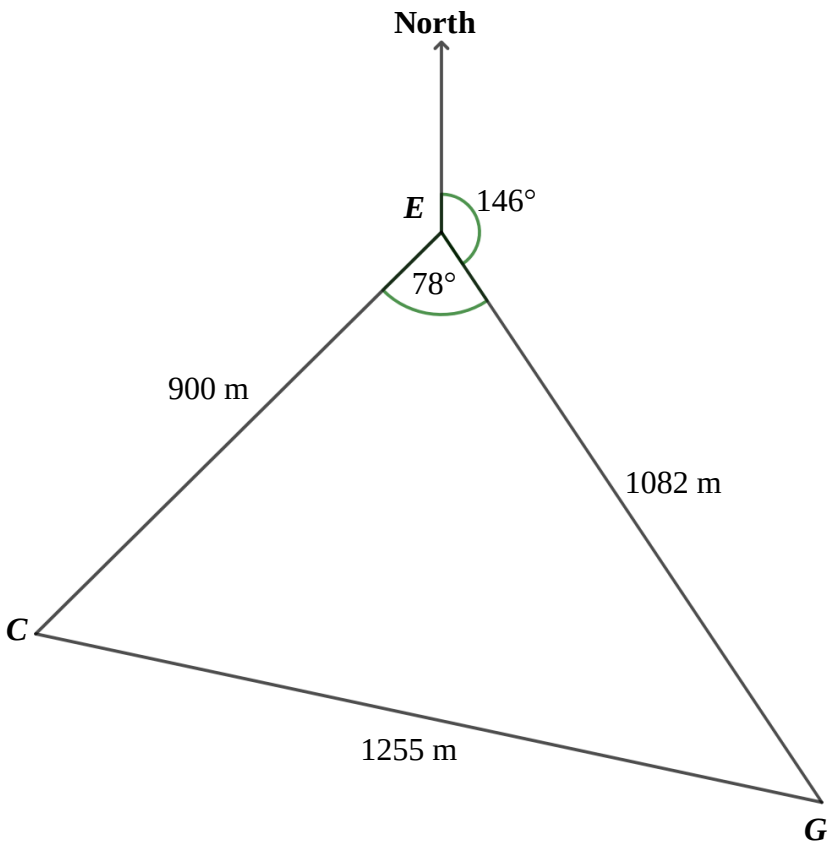
5 Three points, *E*, *C* and *G* lie on a horizontal field.

EC = 900 m, *EG* = 1082 m, *CG* = 1255 m, $\angle CEG = 78°$ and the bearing of *G* from *E* is 146°.



(a) Show that the bearing of E from G is 326°. [1]

Bearing of G from E
=
$360° - (180° - 146°) = 326°$
(shown)

(b) Find

(i) $\angle ECG$,

$$\frac{1082}{\sin \angle ECG} = \frac{1255}{\sin 78°}$$
$$\angle ECG = 57.491456..° = 57.5°$$

Answer ……° [2]

(ii) the bearing of C from G.

$$\angle EGC = 180° - 78° - 57.491456° = 44.5085..°$$

Bearing of C from G
$= 360° - 44.5085 - (180° - 146°)$
$= 281.4915..$
$= 281.5° \,(1 \text{ dp})$

Answer ……° [2]

(c) Find the area of triangle CEG.

Area of Δ CEG
$= \frac{1}{2}(900)(1082)\sin 78°$
$= 476260$
$= 476\,000 \text{ m}^2$ (3 sf)

Answer …… m^2 [2]

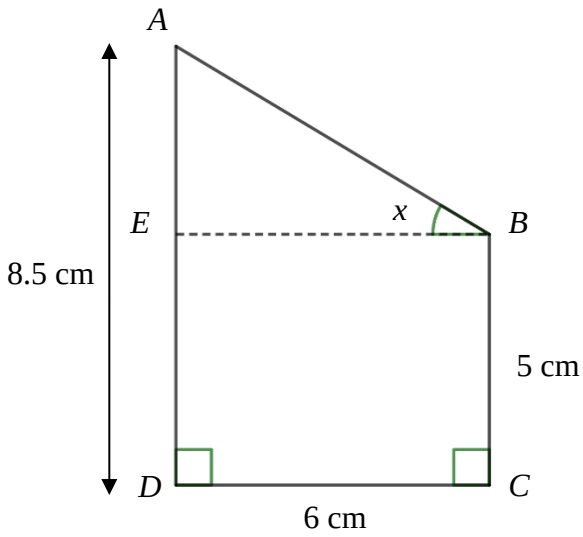
(d) A building of height 80 m is erected at *C*.

Calculate the angle of elevation of the top of the building when viewed from *E*.

$$\tan\theta = \frac{80}{894}$$
$$\theta = 5.11352° = 5.1° \text{ (1 d.p)}$$

Answer ……..…….° [2]

6 *ABCD* is a trapezium such that *BC* = 5 cm, *CD* = 6 cm and *AD* = 8.5 cm.



(a) Calculate the angle *x* shown on the diagram.

$AE = 8.5 - 5 = 3.5$ cm ; *CD* = 6 cm

$$\tan x° = \frac{3.5}{6}$$

$$x° = \tan^{-1}\left(\frac{3.5}{6}\right) = 30.2564.. = 30.3° \text{ (1 dp)}$$

Answer *x* = ……° [2]

(b) Calculate the perimeter of trapezium *ABCD*.

$AB = \sqrt{6^2 + 3.5^2} = 6.94622..$

Perimeter
= 6.94622 + 8.5 + 6 + 5
= 26.44622…
= 26.4 cm (3 sf)

Answer …… cm [2]

7 The stem-and-leaf diagram below shows the first weighted assessment scores of a Secondary 2 class.
There are 30 students in this class and the maximum mark of the paper is 40.

1	2	4	5	5	6	6	7	8	8			
2	0	1	2	2	2	3	5	5	7	8	8	9
3	0	0	1	2	4	4	7	8				
4	0											

Key
1 | 2 means 12 marks

(a) Find the range and the mode of the scores.

Range = $40 - 12 = 28$

Mode = 22

Answer Range = …….. marks

Mode = …….. marks [2]

(b) A student can take Additional Mathematics in Secondary 3 if his or her score is 75% and above.
An Additional Mathematics class can only be created if there are at least 10 students enrolled into it.

Based on the information above, can an Additional Mathematics class be created? Show your working clearly.

Based on the maximum score, 75% is 30 marks.

$40 \times 75\% = 30$

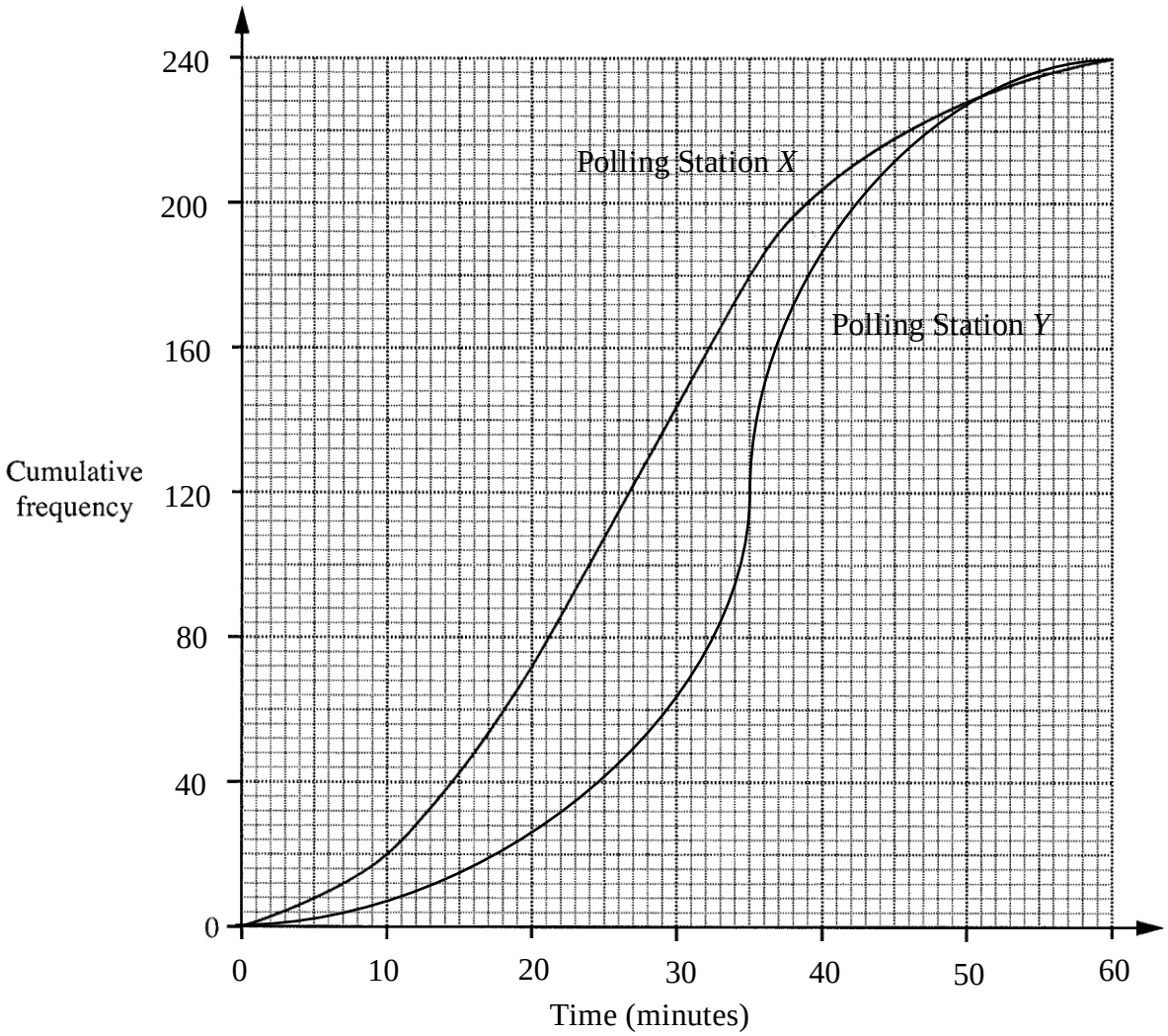
Based on the Stem-and-leaf diagram, there are only

9 students who scored 30 marks and above.

$\therefore$ An Additional Mathematics class cannot be created.

Answer …….. [2]

8 (a) The times taken by 240 people to cast their votes, at both polling station *X* and *Y*, in a country's General Election is shown in the cumulative frequency curve below.



Use the graph to find, for polling station *X*,

(i) the median time,

Median time = 26.5/27

Answer ..... minutes [1]

(ii) the interquartile range.

$Q_1 = 18$
$Q_3 = 35$
Interquartile range
$= 35 - 18$
$= 17$ minutes

Answer ..... minutes [2]

(iii) People who took more than 30 minutes to cast their votes were unhappy with the process.

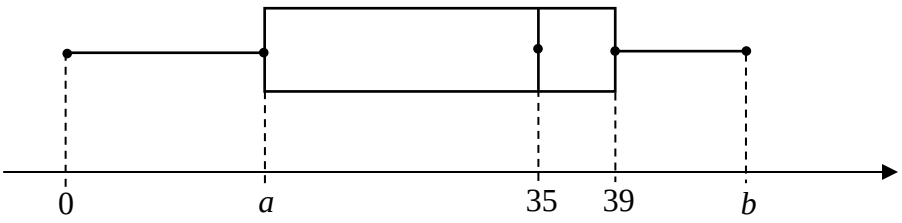
Find the percentage of people at polling station *X* who were unhappy with the process.

Number of people who were unhappy
= 240 − 144
= 96 people

Percentage = $\frac{96}{240} \times 100\% = 40\%$

Answer …….. % [1]

(b) The box-and-whisker plot for the time taken for people to cast their votes at Polling Station *Y* is shown below.



Find the value of *a* and of *b*.

a = 29.5/29
b = 60

Answer *a* = ……

b = …… [2]

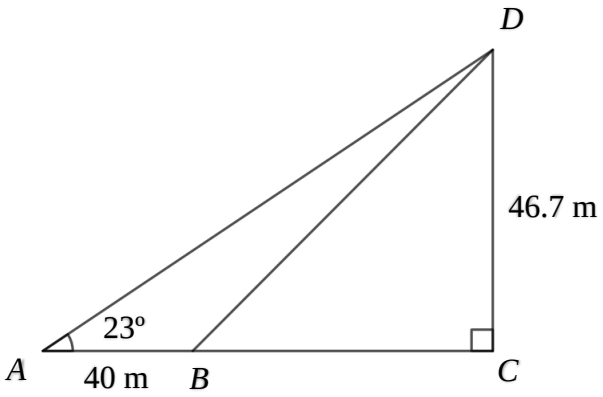
(c) Abby claimed that the times taken by people to cast their votes were more consistent in polling station *X* than in polling station *Y*.

Is the statement true? Give a reason for your answer.

Interquartile range
= 39 − 29.5
= 9.5 minutes
Abby's claim is false.
The interquartile range of times taken by people to cast their votes in station X (i.e. 9.5 minutes) is lower than the interquartile range of times taken in station Y (i.e. 17 minutes).

Extracted from 4NA WA 2022

9 *A* and *B* are two points on level ground. *CD* is a building of height 46.7 m. It is given that the angle of elevation of the top of the building from *A* is 23º and *AB* = 40 m.



Find the angle of depression of *B* from the top of the building.

$\tan 23° = \frac{46.7}{AC}$

$AC = \frac{46.7}{\tan 23°}$

$AC = 110.0183$ m

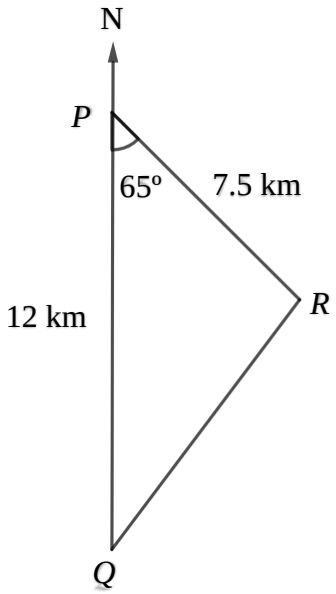
$BC = 110.0183 - 40$
$= 70.0183$ m

$\tan \angle DBC = \frac{46.7}{70.0183}$

$\angle DBC = 33.7°$

Answer …… [4]

10 *P*, *Q* and *R* are three points on level ground. *P* is 12 km due north of *Q*. *PR* = 7.5 km and $\angle QPR = 65^\circ$.



Find

(a) the length of *QR* ,

$QR^2 = 12^2 + 7.5^2 - 2(7.5)(12)\text{Cos } 65°$

$QR^2 = 124.1787$

$QR = 11.14355$
$QR = 11.1$

Answer ..... km [3]

(b) the bearing of *Q* from *R*.

$\angle PRN_1 = 65°$ (alt $\angle s$, OP // RN_1)

$$\frac{\sin \angle PRQ}{12} = \frac{\sin 65°}{11.14355}$$

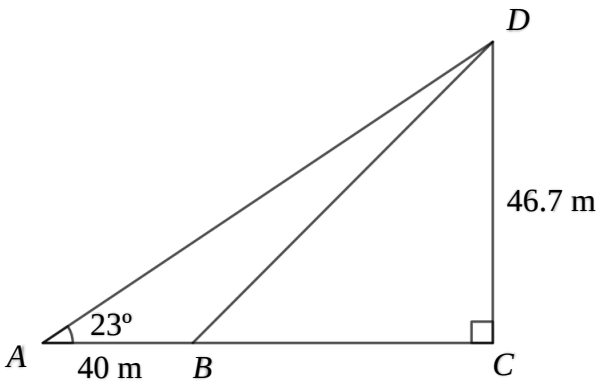
$$\sin \angle PRQ = \frac{\sin 65°}{11.14355} \times 12$$

$\angle PRQ = 77.412°$

bearing of Q from R = $360° - 77.412 - 65$
$= 217.6°$

Answer ..... [3]

11 *A* and *B* are two points on level ground. *CD* is a building of height 46.7 m. It is given that the angle of elevation of the top of the building from *A* is 23º and *AB* = 40 m.



Find the angle of depression of *B* from the top of the building.

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$AC = \dfrac{46.7}{\tan 23°}$

$AC = 110.0183$ m

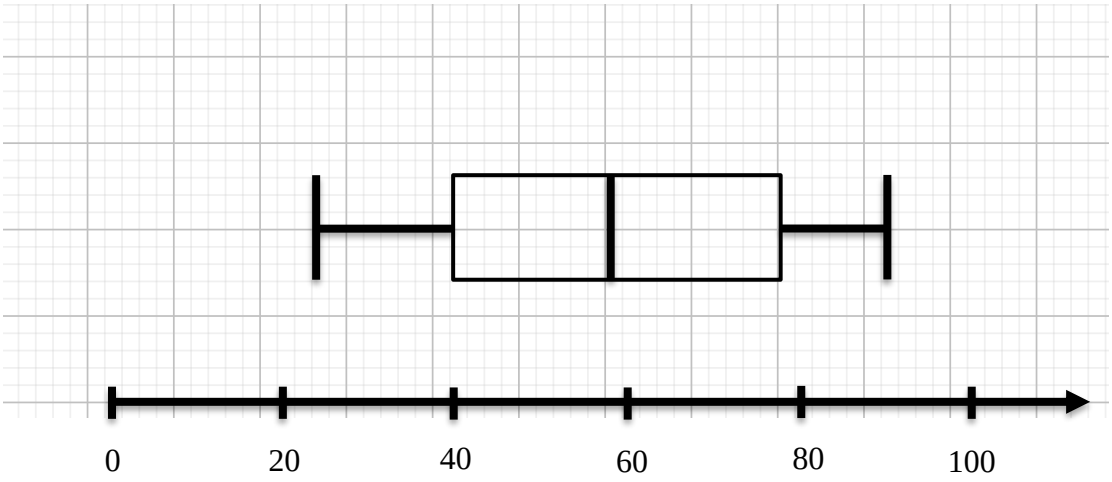
$BC = 110.0183 - 40$
$= 70.0183$ m

$\tan \angle DBC = \dfrac{46.7}{70.0183}$

$\angle DBC = 33.7°$

Answer ..... [4]

12 The box-and-whiskers diagram below shows the results for a Mathematics test for a group of 150 students.



(a) Find

(i) the median mark,

58

Answer ……..……..[1]

(ii) the interquartile range.

78 – 40
= 38

Answer ……..……..[2]

(b) The same group of students also took an English test. The median mark and range for the English test were both 52.

(i) The top student for the English test scored 98 marks, find the lowest score obtained for the English test.

98 – 52
= 46

Answer ……..…….. [1]

(ii) Steven commented that the students did better in English compared to Mathematics.
Explain whether you agree with Steven.

No. Students did better for Mathematics.

The **median** mark for mathematics (58) is **higher** than the median mark for English (52).

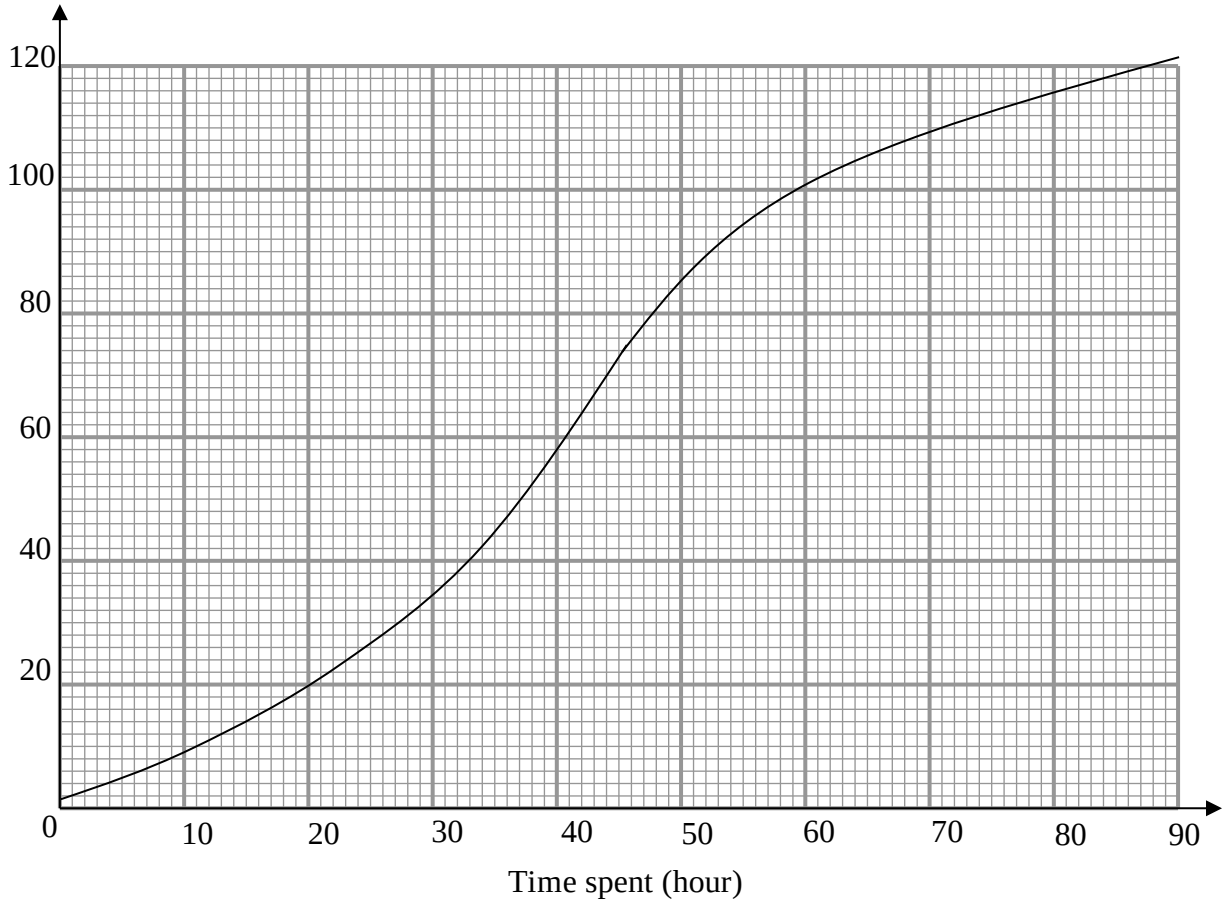
(c) The interquartile range of the English test was 25. Explain the significance of the difference in interquartile range between the English test and the Mathematics test.

Since the interquartile range for English is less than that of Mathematics, there is **less spread** in the English results.

Or

The English results are **more consistent**.

13 The cumulative frequency graph below shows the distribution of the average time spent on computer games per week by 120 teenagers.



(a) Find

(i) the lower quartile

28

Answer ……..… hour [1]

(ii) the 40th percentile

37

Answer ……..… hour [1]

(b) Find the number of students who spend between 10 and 50 hours a week on computer games.

84 – 8
= 76

Answer ……..…….. [2]

(c) A teenager is considered to be a gaming addict if he spends more than 60 hours a week on computer games. Calculate the percentage of teenagers who are gaming addicts. Give your answer correct to 3 significant figures.

$\frac{20}{120} \times 100\%$

$= 16.7\%$

Answer ……..…… % [2]

14 The stem-and-leaf diagram below shows the distribution of the weight of puppies.

Stem	Leaf
0	4 7
1	2 2 3 5 7 9
2	1 2 3 3 ***a*** 4 9
3	4 ***b*** 5 5 ***c***

Key: 1 | 2 represents 1.2 kg

(a) It is given that the mean and mode of the weight of the puppies are 2.2 and 2.3 respectively.
Write down the values of *a*, *b* and *c*.

$a = 3$
$b = 4$

$x + 40.2 = 2.2 \times 20$
$x + 40.2 = 44$
$x = 3.8$
$c = 8$

Answer a = ……..…….. [1]

Answer b = ……..…….. [1]

Answer c = ……..…….. [2]

(b) Find the median weight.

2.25

Answer ……..… kg [1]

The weight of the puppies are represented using a pie chart.

(c) Calculate the angle representing the weight of puppies between 1kg and 2kg.

$\frac{6}{20} \times 360 = 108$

Answer ……..…….. [2]