Surname: | Forename(s):

GCSE Mathematics – Higher Tier

Paper 1 – Non Calculator

Practice Set A

ANSWERS

/40

Materials

- **Formulae Sheet** (on the next page)
- **Black** ink or ball-point pen
- Pencil
- Eraser
- Protractor
- Compass
- Tracing Paper
- **No calculator allowed**

Instructions

- Time allowed: **45 minutes.**
- The total mark for this paper is **40**.
- Show **all** of your working.
- Draw diagrams in pencil.
- Plot graphs in pencil.
- Diagrams are **not** accurately drawn, unless otherwise indicated.
- Cross through any work you don't want to be marked

Higher Tier Formulae Sheet

Perimeter, Area and Volume

Where a and b are the lengths of the parallel sides and h Is their perpendicular separation:

Area of a trapezium = ½ (a + b) h

Volume of a prism = area of cross section x length

Where r is the radius and d is the diameter:

Circumference of a circle = 2πr = πd

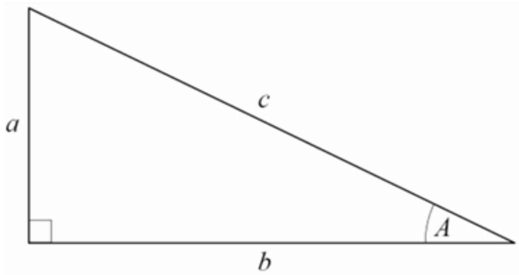
Area of a circle = πr^2

Quadratic Formula

The solution of $ax^2 + bx + c = 0$ where $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Pythagoras' Theorem and Trigonometry

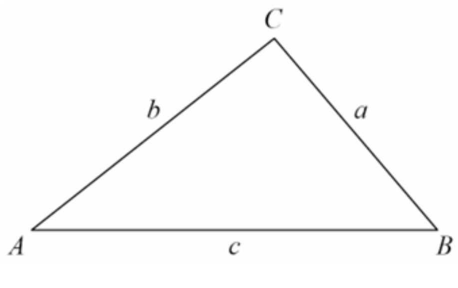


In any right-angled triangle where a, b and c are the length of the sides and c is the hypotenuse:

$$a^2 + b^2 = c^2$$

In any right-angled triangle ABC where a, b and c are the length of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \qquad \cos A = \frac{b}{c} \qquad \tan A = \frac{a}{b}$$



In any triangle ABC where a, b and c are the length of the sides:

sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

Area of triangle $= \dfrac{1}{2} ab \sin C$

Compound Interest

Where P is the principal amount, r is the interest rate over a given period and n is number of times that the interest is compounded:

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

Probability

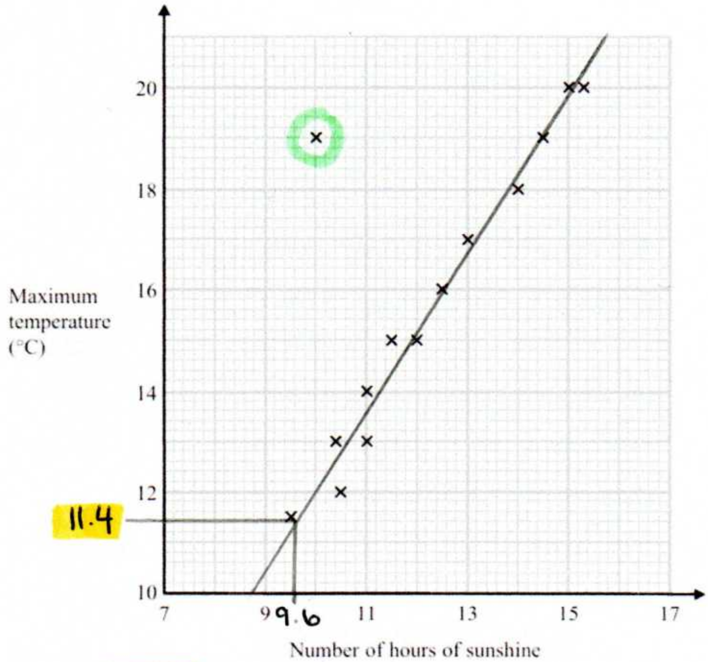
Where P (A) is the probability of outcome A

and P (B) is the probability of outcome B:

P (A or B) = P (A) + P (B) – P (A and B)

P (A and B) = P (A given B) P(B)

1 The scatter graph shows that maximum temperature and the number of hours of sunshine in fourteen towns on one day.



One of the points is an outlier.

(a) Write down the coordinates of this point

(10 , 19)

(1)

(b) For all the other points, write down the type of correlation shown.

positive

(1)

On the same day, in another town, the maximum temperature was 11.4°C.

(c) Estimate the number of hours of sunshine in this town on this day.

9.6 hours

(2)

A weather man says, "Temperatures are higher on days when there is more sunshine."

(d) Does the scatter graph support what the weather man says?
Give reason for your answer.

Yes, as there is a positive correlation between maximum temperature and number of hours of sunshine.
OR No, as correlation does not equal causation.

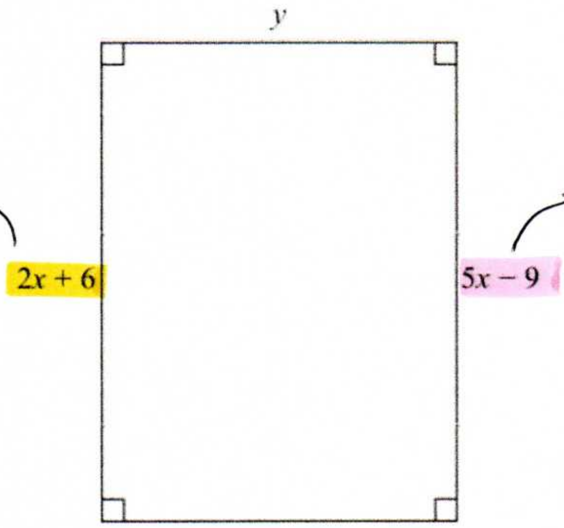
(1)

(Total for question 1 is 5 marks)

2 Here is a rectangle.

$2(5)+6=16$

$5(5)-9=16$



All measurements are in centimetres.
The area of the rectangle is 80cm^2.
Show that y = 5

$2x+6=5x-9$

$+9$ $\quad$ $+9$

$2x+15=5x$

$-2x$ $\quad$ $-2x$

$15=3x$

$\div 3$ $\quad$ $\div 3$

$5=x$

Area = base × height

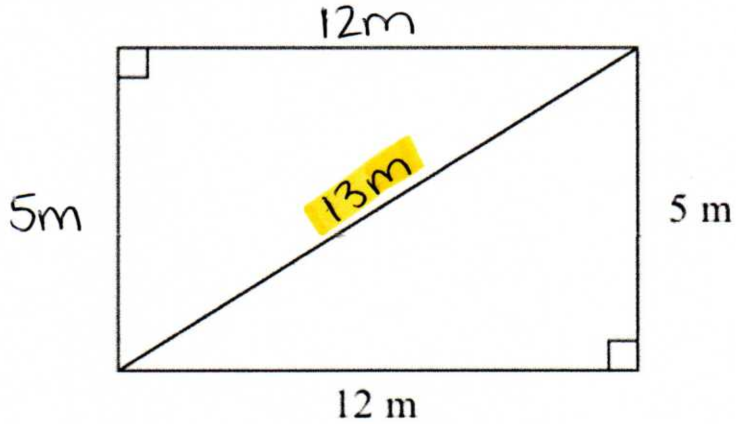
$80=y\times 16$

$\div 16$ $\quad$ $\div 16$

$\boxed{5=y}$

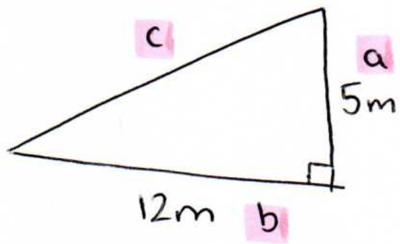
(Total for question 2 is 4 marks)

3 This is a rectangular frame made from 5 straight pieces of wood.



The weight of the wood is 1.2kg per metre.

Work out the total weight of the wood needed to make the frame.



$a^2 + b^2 = c^2$

$5^2 + 12^2 = c^2$

$25 + 144 = c^2$

$169 = c^2$

$13 = c$

Total length = 12 + 5 + 12 + 5 + 13 = 47

$47 \times 1.2 = 56.4$

$$\begin{array}{r} 47 \\ \times\ 12 \\ \hline 94 \\ +\ 470 \\ \hline 564 \end{array}$$

56.4 kg

(Total for question 3 is 5 marks)

4 There are 10 boys and 20 girls in a class.

The class sat an exam.

The mean mark for all students in the class is 60
The mean mark for the girls in the class is 54.

Work out the mean mark for the boys in the class.

Total mark (all students) = $60 \times 30 = 1800$

Total mark (girls) = $54 \times 20 = 1080$

Total mark (boys) = $1800 - 1080 = 720$

mean mark (boys) = $720 \div 10 = 72$

72

(Total for question 4 is 3 marks)

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5 Write the following numbers in order of size.
Start with the smallest number.

3	4	2	1
$0.2\dot{4}\dot{6}$	$0.24\dot{6}$	$0.\dot{2}4\dot{6}$	0.246
0.2464646...	0.2466666...	0.246246246...	0.246

$0.246,\ 0.\dot{2}4\dot{6},\ 0.2\dot{4}\dot{6},\ 0.24\dot{6}$

(Total for question 5 is 2 marks)

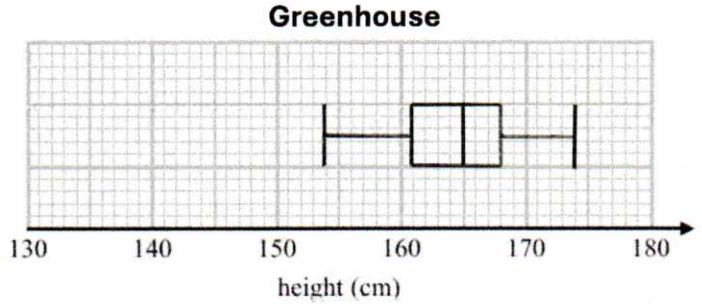
6 The table shows information about the heights, in cm, of some sunflowers grown in a greenhouse.

	height (cm)
least height	154
median	165
lower quartile	161
interquartile range	7
range	20

Upper Quartile
= 161 + 7 = 168

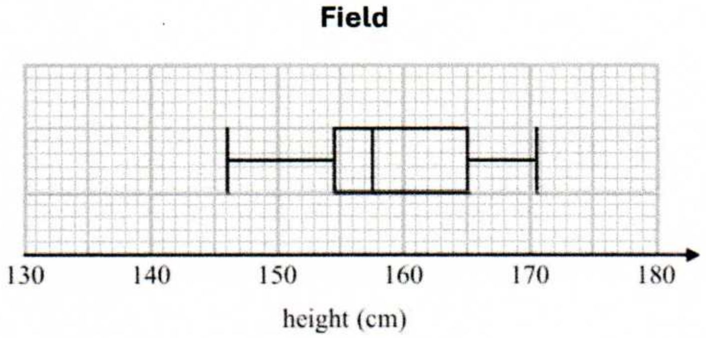
Most Height
= 154 + 20 = 174

(a) Draw a box plot for this information.



(3)

The box plot below shows information about the heights, in cm, of some sunflowers grown in a field.



(b) Compare the distribution of heights of the sunflowers grown in the greenhouse with the distribution of heights of the sunflowers grown in the field.

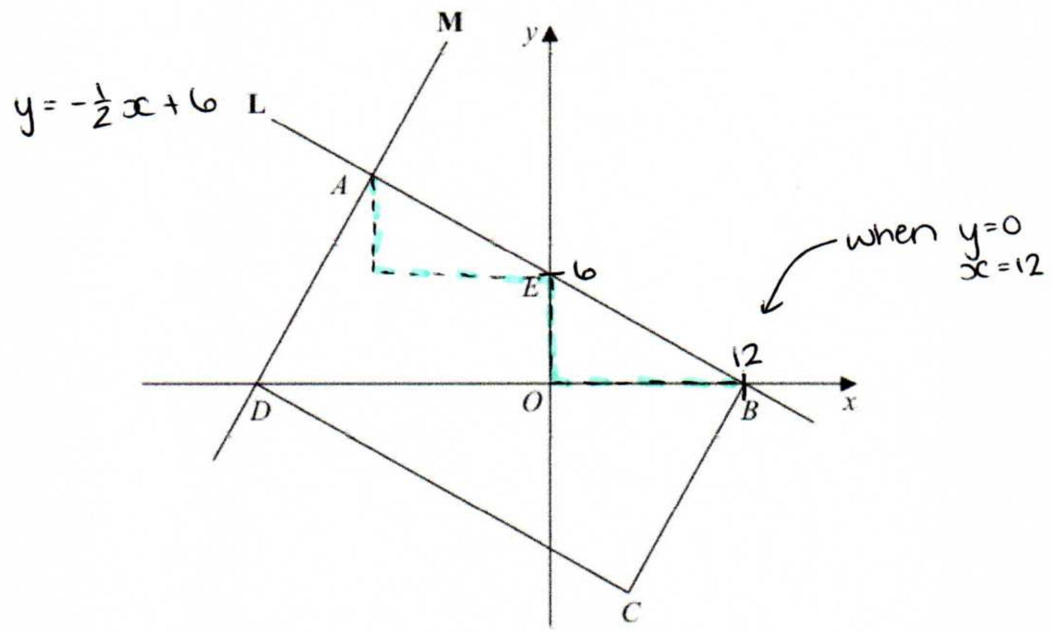
On average, sunflowers in the greenhouse are taller as the median is higher. (and vice versa)

The spread of the heights of sunflowers in the greenhouse is more concise as the range (or IQR) is smaller. (and vice versa).

(2)

(Total for question 6 is 5 marks)

7



ABCD is a rectangle.
A, E and B are points on the straight line **L** with equation 12 = 2y + x
A and D are points on the straight line **M**.
AE = EB

Find an equation for line **M**.

Line L

$12 = 2y + x$ $-x$ $-x$

$12 - x = 2y$ $\div 2$ $\div 2$

$6 - \frac{1}{2}x = y$

$y = \underset{\uparrow\,\text{gradient}}{-\frac{1}{2}}x + 6$

A (−12, 12)

Line L and Line M are perpendicular

gradient of $L = -\frac{1}{2}$

$\therefore$ gradient of $M = 2$

$y = mx + c$

$12 = 2(-12) + c$

$12 = -24 + c$

$36 = c$

Line M

$y = 2x + 36$

(Total for question 7 is 4 marks)

8 n is an integer greater than 1
Prove algebraically that $n^2 - 2 - (n-2)^2$ is always an even number.

$n^2 - 2 - (n-2)^2$

↳ $n^2 - 2 - (n-2)(n-2)$

↳ $n^2 - 2 - (n^2 - 2n - 2n + 4)$

↳ $n^2 - 2 - (n^2 - 4n + 4)$

↳ $n^2 - 2 - n^2 + 4n - 4$

↳ $4n - 6$

↳ $2(2n-3)$

multiple of 2 ∴ is always an even number

(Total for question 8 is 4 marks)

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9 Show that $\frac{6-\sqrt{8}}{\sqrt{2}-1}$ can be written in the form $a + b\sqrt{2}$ where a and b are integers.

$\sqrt{8} = \sqrt{4} \times \sqrt{2}$

$= 2\sqrt{2}$

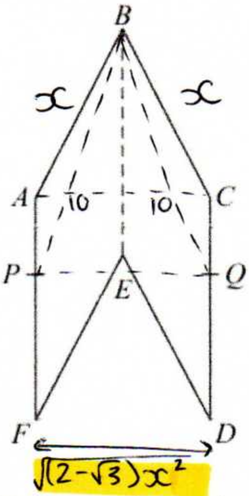
$$\frac{(6-2\sqrt{2})}{(\sqrt{2}-1)} \times \frac{(\sqrt{2}+1)}{(\sqrt{2}+1)} = \frac{6\sqrt{2} + 6 - 4 - 2\sqrt{2}}{2 + \sqrt{2} - \sqrt{2} - 1}$$

$$= \frac{4\sqrt{2} + 2}{1}$$

$$= 4\sqrt{2} + 2$$

(Total for question 9 is 3 marks)

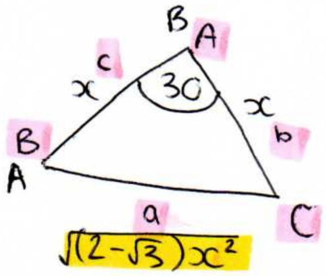
10 The diagram shows a hexagon ABCDEF.



$ABEF$ and $CBED$ are congruent parallelograms where $AB = BC = x$ cm.
P is the point on AF and Q is the point on CD such that $BP = BQ = 10$ cm.

Given that angle $ABC = 30°$,

prove that $\cos PBQ = 1 - \frac{(2-\sqrt{3})}{200}x^2$

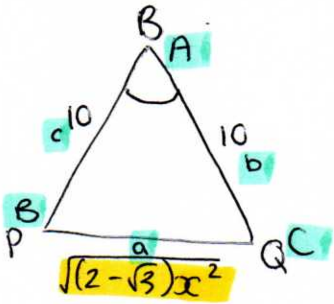


$a^2 = b^2 + c^2 - 2bc\cos A$ → $\cos 30 = \frac{\sqrt{3}}{2}$

$a^2 = x^2 + x^2 - 2xx\cos 30$

$a^2 = 2x^2 - \sqrt{3}x^2$

$a^2 = (2-\sqrt{3})x^2 \Rightarrow a = \sqrt{(2-\sqrt{3})x^2}$



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

$\cos PBQ = \frac{10^2 + 10^2 - \left(\sqrt{(2-\sqrt{3})x^2}\right)^2}{2(10)(10)}$

$\cos PBQ = \frac{200 - (2-\sqrt{3})x^2}{200}$

$\cos PBQ = 1 - \frac{(2-\sqrt{3})}{200}x^2$

(Total for question 10 is 5 marks)

END OF TEST

TOTAL FOR THIS PAPER IS 40 MARKS