9	M	E	2	(	Q	)

Education Bureau

Territory-wide System Assessment 2022

Secondary 3 Mathematics

QUESTION BOOKLET

INSTRUCTIONS

1. There are 47 questions in this paper.
2. Time allowed is 65 minutes.
3. Answer ALL questions in the separate ANSWER BOOKLET.
4. The use of HKEAA approved calculators is permitted.
5. Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.
6. Rough work should be done on the rough work sheet provided.
7. The diagrams in this paper are not necessarily drawn to scale.

FORMULAS FOR REFERENCE

Sector	Arc length	=	$2\pi r \times \frac{\theta}{360^\circ}$
	Area	=	$\pi r^2 \times \frac{\theta}{360^\circ}$
Sphere	Surface area	=	$4\pi r^2$
	Volume	=	$\frac{4}{3}\pi r^3$
Cylinder	Curved surface area	=	$2\pi rh$
	Volume	=	$\pi r^2 h$
Cone	Curved surface area	=	πrl
	Volume	=	$\frac{1}{3}\pi r^2 h$
Prism	Volume	=	base area × height
Pyramid	Volume	=	$\frac{1}{3}$ × base area × height

SECTION A: Choose the best answer for each question.
You should mark all your answers in the ANSWER BOOKLET.

1. $7.16 \times 10^{-5} =$

A. 0.000 071 6 .

B. – 0.000 071 6 .

C. 0.000 007 16 .

D. – 0.000 007 16 .

2. The number of positive integers less than $\sqrt{15}$ is

A. 5.

B. 4.

C. 3.

D. 2.

3. Which of the following is a polynomial ?

A. $\frac{\sqrt{x}}{6} - 8$

B. $\frac{6}{\sqrt{x}} - 8$

C. $\frac{x^4}{6} - 8$

D. $\frac{6}{x^4} - 8$

4. Karen is m years old now. 9 years ago, her age was $\frac{1}{4}$ of her present age . Which of the following equations can be used to find the value of m ?

A. $m - 9 = 4m$

B. $m - 9 = \frac{m}{4}$

C. $m + 9 = 4m$

D. $m + 9 = \frac{m}{4}$

5. Which of the following points lies on the straight line $y = 6$?

A. (2, 6)

B. (–6, 0)

C. (6, 2)

D. (0, –6)

6. The prices of a box of coloured pencils and a box of crayons are $\$x$ and $\$y$ respectively. 3 boxes of coloured pencils and 2 boxes of crayons cost \$152 in total. The price of a box of coloured pencils is lower than that of a box of crayons by \$6. Which of the following pairs of simultaneous equations shows the relation between x and y ?

A. $\begin{cases} 3x + 2y = 152 \\ y - x = 6 \end{cases}$

B. $\begin{cases} 3x + 2y = 152 \\ x - y = 6 \end{cases}$

C. $\begin{cases} 2x + 3y = 152 \\ y - x = 6 \end{cases}$

D. $\begin{cases} 2x + 3y = 152 \\ x - y = 6 \end{cases}$

7. If $x > y$, which of the following inequalities is correct?

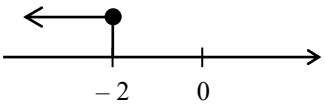
A. $x - 8 < y - 8$

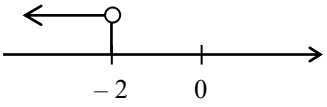
B. $8x < 8y$

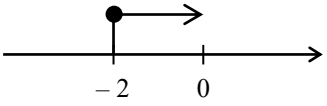
C. $\frac{x}{8} < \frac{y}{8}$

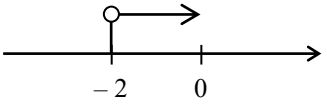
D. $-\frac{x}{8} < -\frac{y}{8}$

8. Which of the following diagrams represents $x < -2$?

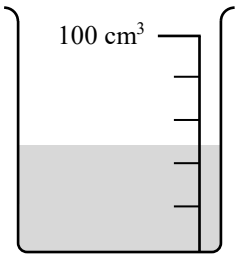
A.


B.


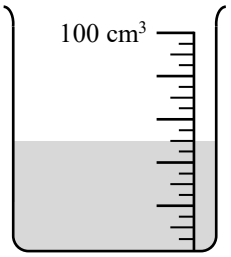
C.


D.


9.



Beaker *A*



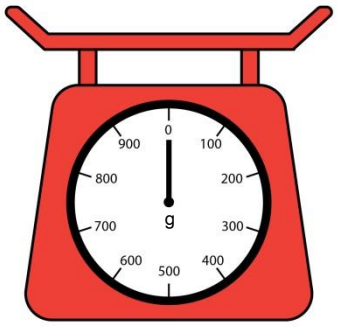
Beaker *B*

The above figure shows Beaker *A* and Beaker *B* with different graduations. There is some water in each beaker. Tommy wants to find the volume of a small iron ball. Which of the following methods is **the best**?

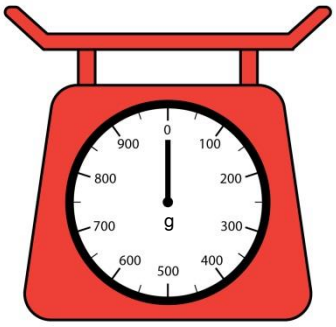
A. Tommy puts a small iron ball in Beaker *A* and measures the volume increased.
B. Tommy puts a small iron ball in Beaker *B* and measures the volume increased.
C. Tommy puts 30 identical small iron balls in Beaker *A*, measures the volume increased, and then divides the volume by 30.
D. Tommy puts 30 identical small iron balls in Beaker *B*, measures the volume increased, and then divides the volume by 30.

10. Anna measures the weight of a water bottle  . Which of the following scales can give a more accurate measurement?

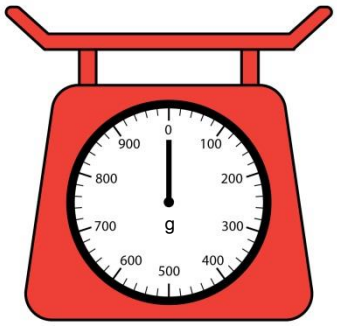
A.



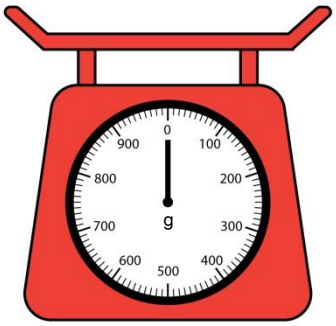
B.



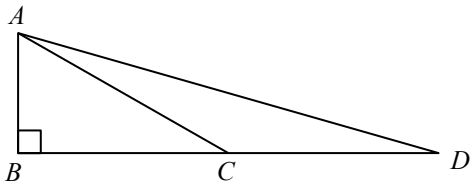
C.



D.



11. In the figure, $\triangle ABD$ is a right-angled triangle and BCD is a straight line. Which of the following is an obtuse angle?



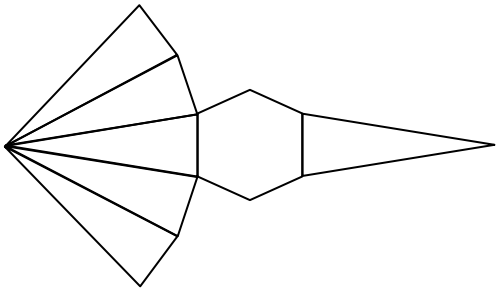
A. $\angle ABC$

B. $\angle ACD$

C. $\angle BCA$

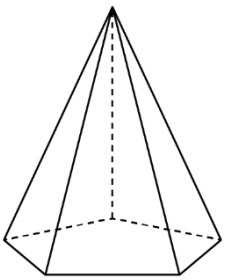
D. $\angle BCD$

12.

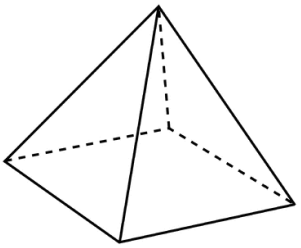


Which of the following 3-D figures can be made by the net above?

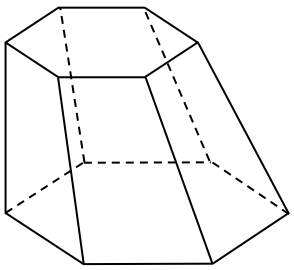
A.



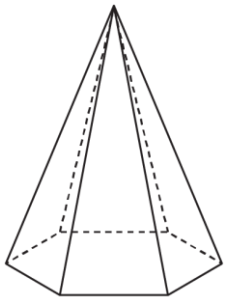
B.



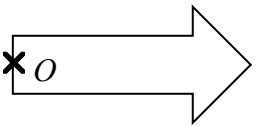
C.



D.

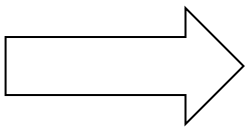


13.

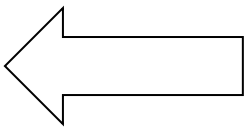


Find the image of the above figure after rotating about O through $180°$ in an anticlockwise direction.

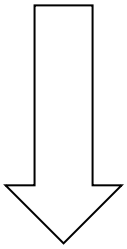
A.



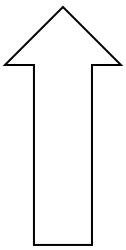
B.



C.

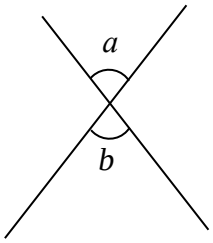


D.

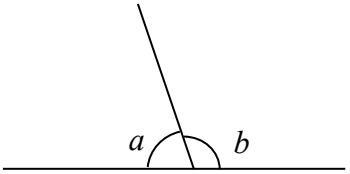


14. Which of the following figures shows that a and b are angles at a point?

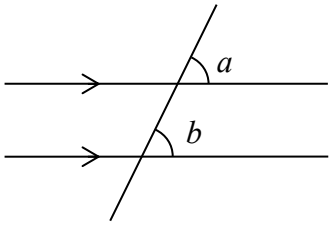
A.



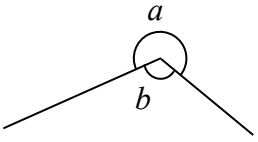
B.



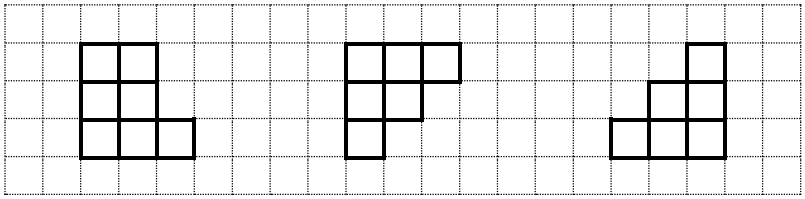
C.



D.



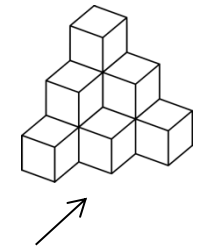
15. The figures below show the 2-D representations of a solid from various views.



front view top view side view

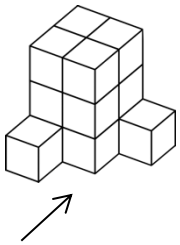
Which of the following could be the solid?

A.



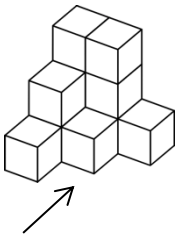
front

B.



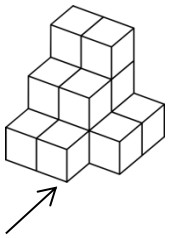
front

C.



front

D.



front

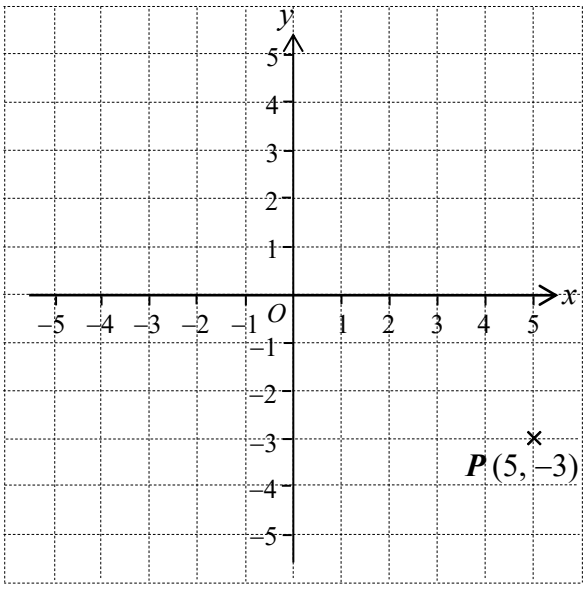
16. In the figure, $\boldsymbol{P}\,(5, -3)$ is rotated about the origin O through $90°$ in an anticlockwise direction to $\boldsymbol{P'}$. Find the coordinates of $\boldsymbol{P'}$.

A. $(-5, -3)$

B. $(5, 3)$

C. $(3, 5)$

D. $(-3, -5)$



Go on to the next page

17. P (4, 15) and Q (0, –9) are two points in the rectangular coordinate plane. The coordinates of the mid-point of PQ are

A. (4, 6) .

B. (4, 24) .

C. (2, 3) .

D. (2, 12) .

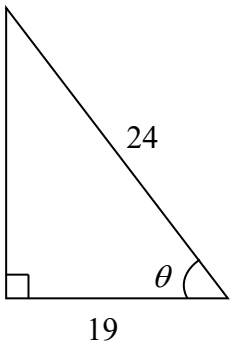
18. Referring to the figure, find θ. (Correct to 3 significant figures)

A. 37.7°

B. 38.4°

C. 51.6°

D. 52.3°



19. The student union of a secondary school wants to collect opinions from students on the activities they organised this academic year. Which of the following is the most suitable method to collect data?

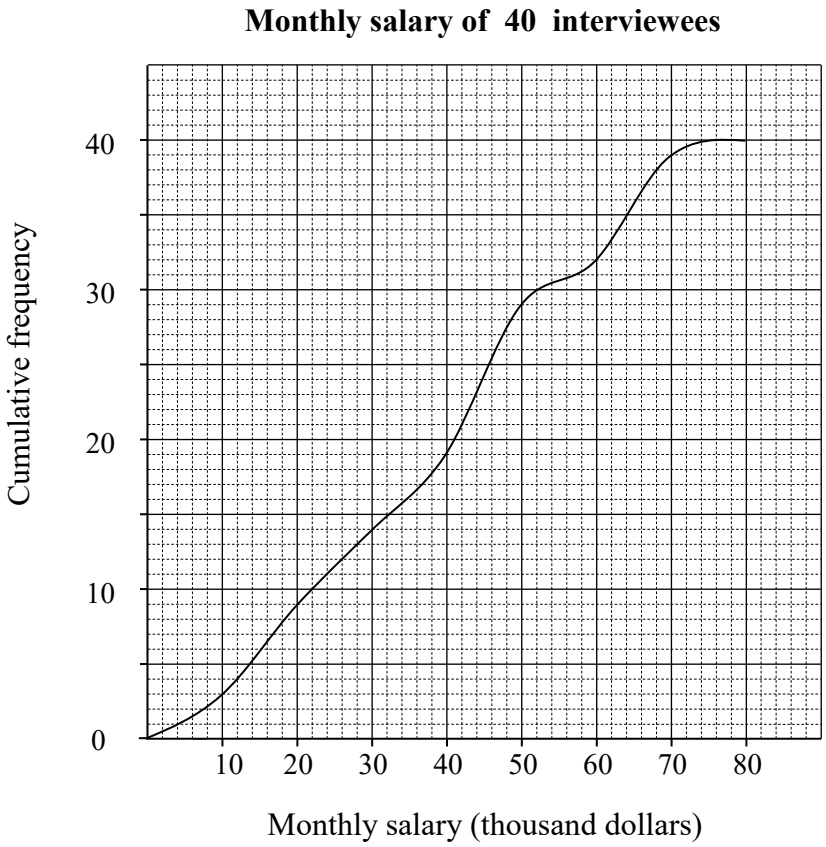
A. Conduct a survey of all students using questionnaires.

B. Search photos of the relevant activities on the school website.

C. Conduct a survey of nearby residents of the school randomly using questionnaires.

D. Review the rundown of the relevant activities.

20. The cumulative frequency curve below shows the monthly salary of 40 interviewees.



Find the upper quartile of the monthly salary of the 40 interviewees.

A. $60 000

B. $52 000

C. $22 000

D. $20 000

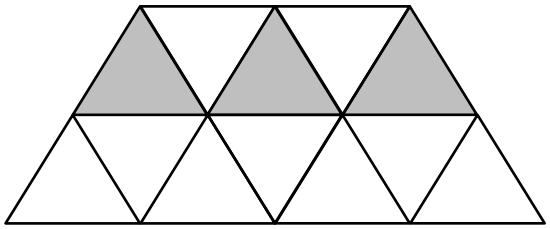
SECTION B: Write ALL the answers in the ANSWER BOOKLET.
Working need not be shown.

21. Calculate $-4\times2-1$.

22. A scientific formula is given as follows:

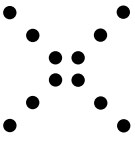
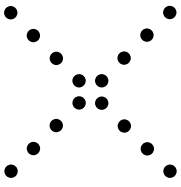
$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}$$

If $R_1 = 6$ and $R_2 = 12$, find the value of R.

23. 

In the figure, there are 12 identical equilateral triangles and 3 of them are shaded. Find the ratio of the number of shaded equilateral triangles to the number of equilateral triangles in white.

24. Figure 1 to Figure 4 consist of 4, 8, 12 and 16 dots respectively.

			
Figure 1	Figure 2	Figure 3	Figure 4

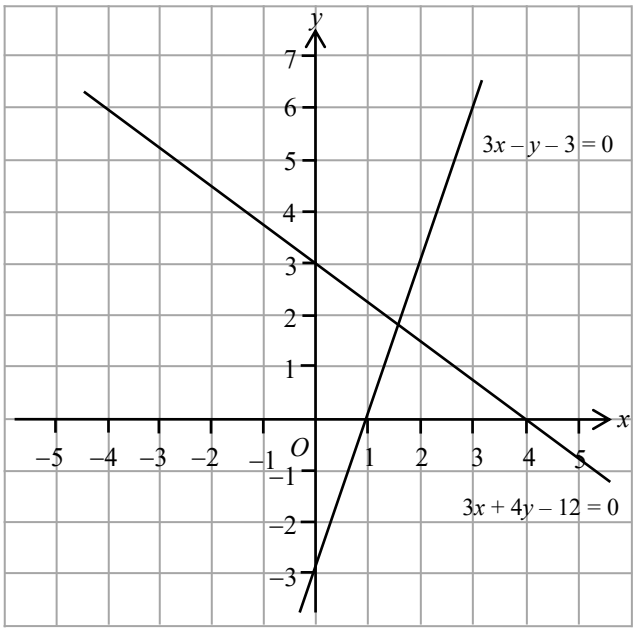
According to the above pattern, how many dots does Figure n consist of ? (Express the answer in terms of n)

25. Expand $(1 + x + y)\,y$.

26. Expand $(x - 2)(x - 3)$.

27. Factorize $9x^2 - 6x + 1$.

28.



The above figure shows the graphs of $3x - y - 3 = 0$ and $3x + 4y - 12 = 0$.

According to the given graphs, $(2, 2)$ is the * exact solution / approximate solution of the simultaneous equations $\begin{cases} 3x - y - 3 = 0 \\ 3x + 4y - 12 = 0 \end{cases}$.

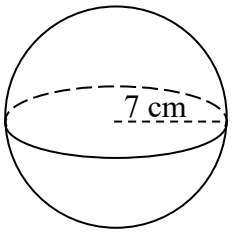
(*Circle the correct answer in the **ANSWER BOOKLET**)

29. Consider the formula $c = \sqrt{a^2 - b^2}$. If $a = 8$ and $b = -5$, find the value of c.

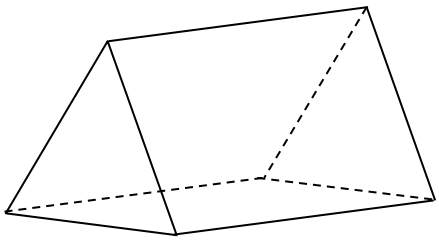
30. In the **ANSWER BOOKLET**, fill in the box with $>$ or $<$ to express the relation between the numbers.

$$\frac{11}{8} \quad \square \quad \frac{11}{9}$$

31. The figure shows a sphere of radius 7 cm. Find the surface area of the sphere. Express the answer in terms of π.

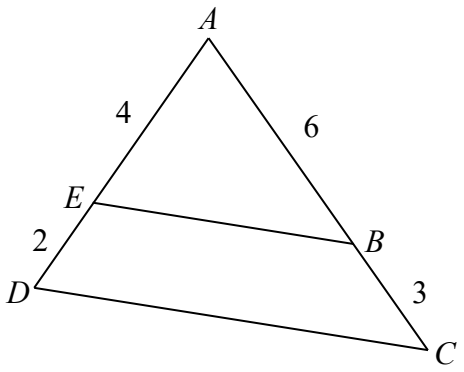


32. The figure shows the diagram of a triangular prism:



Referring to the sketch shown above, add solid line(s) and dotted line(s) in the figure provided in the **ANSWER BOOKLET** so as to form a diagram of a **cuboid**.

33.

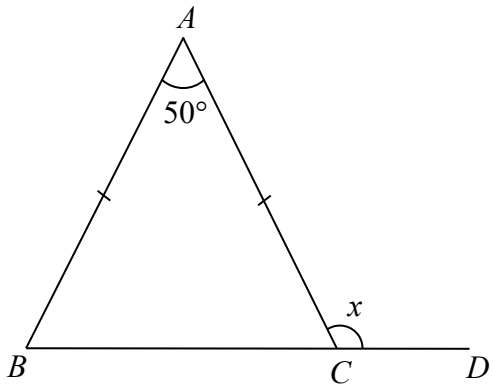


According to the given information in the above figure,

(a) identify whether $\triangle ABE$ and $\triangle ACD$ are congruent or similar triangles, and

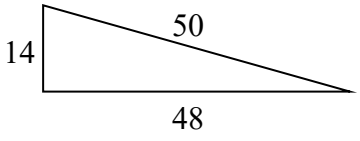
(b) choose the correct reason.

34. In the figure, BCD is a straight line. $\triangle ABC$ is an isosceles triangle, where $AB = AC$ and $\angle BAC = 50°$. Find x.

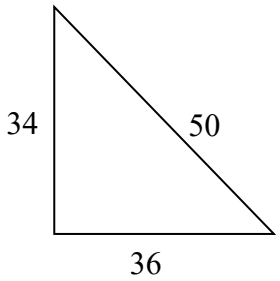


35. Which of the following must be right-angled triangle(s)? (May be more than one answer)

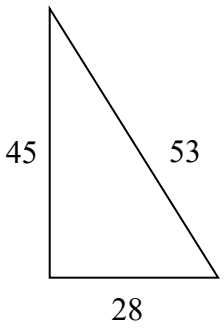
Triangle P



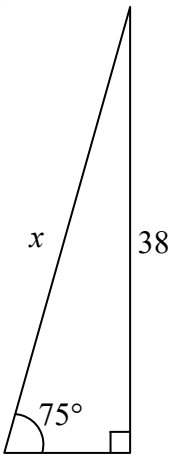
Triangle Q



Triangle R



36. Find the value of x in the figure. (Correct to 3 significant figures)



37. The following data show the number of passengers taking the first bus at the terminus of a bus route of 20 working days in the last month.

46	25	30	32	18
23	35	49	51	38
69	16	52	14	11
32	44	48	15	59

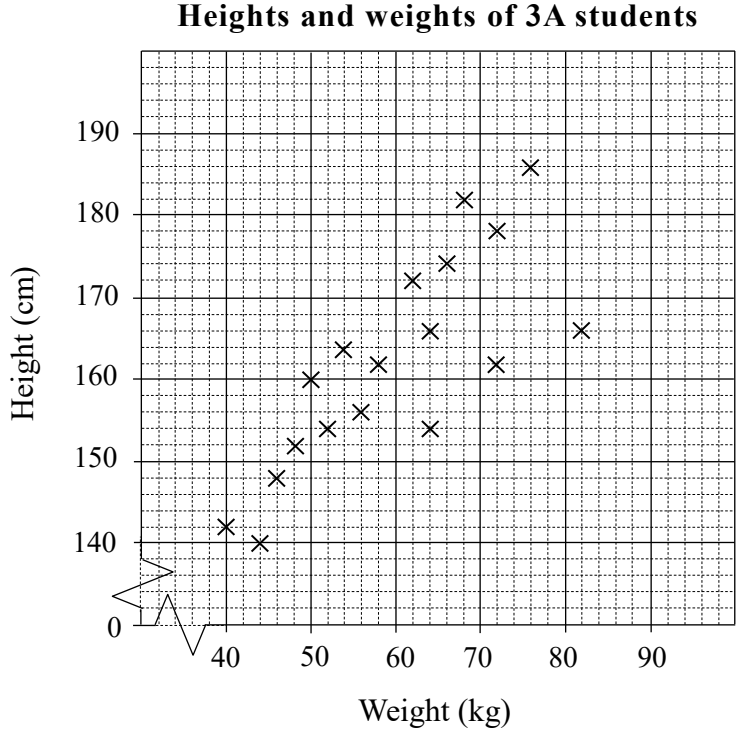
Use the data to complete the two frequency distribution tables in the **ANSWER BOOKLET**.

38. The table below shows the distribution of the age of 150 members of a community centre.

Age (years old)	40 – 49	50 – 59	60 – 69	70 – 79	80 – 89
Number of members	2	13	59	61	15

Find the modal class of the age of the 150 members.

39. The scatter diagram below shows the heights (cm) and the weights (kg) of 3A students. There are no students of the same height and weight in the class.



According to the above scatter diagram, answer the following questions.

(a) Jack is the tallest student in class 3A. Find his weight.

(b) How many students of height over 170 cm are there in the class?

(c) How many students are there in class 3A?

SECTION C: All working must be clearly shown.
Write the mathematical expressions, answers and statements/conclusions in the spaces provided in the ANSWER BOOKLET.

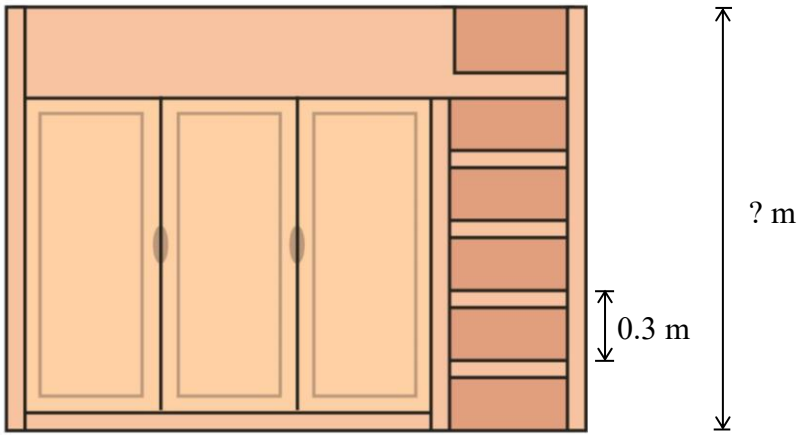
40. The marked price of a ticket at a theme park is 560. It is sold for 448 now.
Find the discount per cent.

41. Complete the table for the equation $x + y - 1 = 0$ in the **ANSWER BOOKLET**.

x	-3	0	3
y		1	

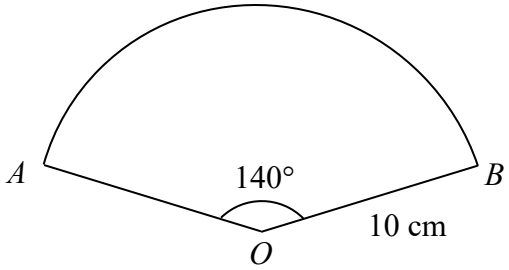
According to the table, draw the graph of this equation on the rectangular coordinate plane given in the **ANSWER BOOKLET**.

42. The figure shows a loft bed with a ladder. The distance between two of the steps of the ladder is 0.3 m. Estimate the height of the loft bed and explain your estimation method.

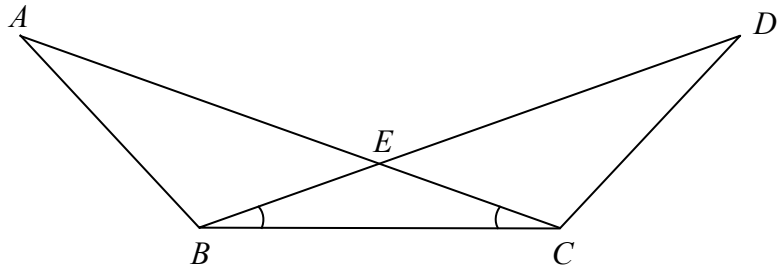


43. Solve the simultaneous equations $\begin{cases} x - 2y = -5 \\ x + 2y = 11 \end{cases}$.

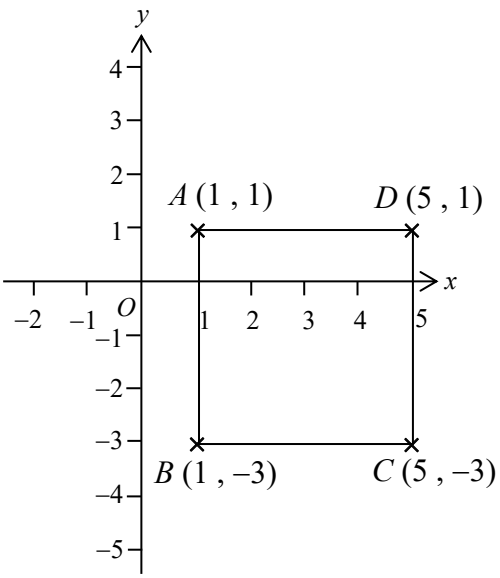
44. In the figure, the radius of sector OAB is 10 cm and $\angle AOB = 140°$. Find the area of the sector. Give the answer correct to 3 significant figures.



45. In the figure, $AC = DB$ and $\angle ACB = \angle DBC$. Prove that $\triangle ABC \cong \triangle DCB$.



46. Find the area of the square in the figure.



47. The table below shows the distribution of the heights of 25 plants belonging to a school gardening club.

Height (cm)	Class boundaries (cm)	Class mark (cm)	Frequency
10 – 19	9.5 – 19.5		5
20 – 29	19.5 – 29.5	24.5	7
30 – 39		34.5	6
40 – 49	39.5 – 49.5	44.5	7

(a) According to the above table, complete the frequency distribution table in the **ANSWER BOOKLET**.

(b) According to the above table, complete the histogram in the **ANSWER BOOKLET**.

END OF PAPER