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Education Bureau
Territory-wide System Assessment 2020
Secondary 3 Mathematics
QUESTION BOOKLET

Gainful Use of TSA 2020 Materials

INSTRUCTIONS

1. There are 68 questions in this paper.
2. Estimated time for completion is 75 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 rough work sheet.
7. The diagrams in this paper are not necessarily drawn to scale.

FORMULAS FOR REFERENCE

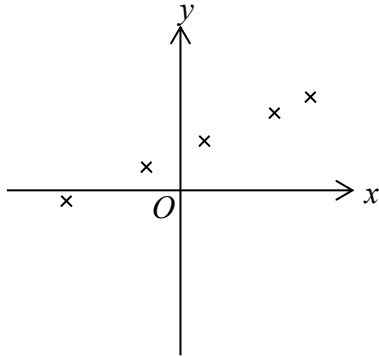
Sector	Arc length	$= 2\pi r \times \frac{\theta}{360^\circ}$
	Area	$= \pi r^2 \times \frac{\theta}{360^\circ}$
Sphere	Surface area	$= 4\pi r^2$
	Volume	$= \frac{4}{3}\pi r^3$
Cylinder	Curved surface area	$= 2\pi r h$
	Volume	$= \pi r^2 h$
Cone	Curved surface area	$= \pi r l$
	Volume	$= \frac{1}{3}\pi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

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

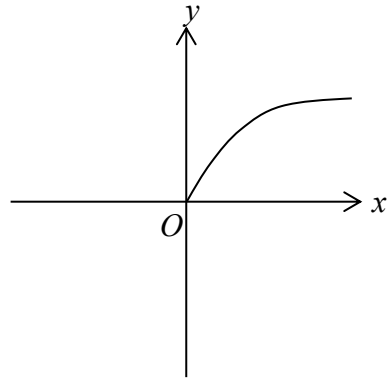
1. $-4.97 \times 10^5 =$
- A. $-0.000\ 049\ 7$.
 - B. $0.000\ 049\ 7$.
 - C. $-497\ 000$.
 - D. $497\ 000$.
2. Johnny is k years old now. Three years ago, his father was 5 times as old as Johnny. The age of his father three years ago was
- A. $5k$ years old.
 - B. $(5k - 12)$ years old.
 - C. $(5k - 3)$ years old.
 - D. $5(k - 3)$ years old.
3. Which of the following is a polynomial ?
- A. $\frac{x^3}{3} + 1$
 - B. $\frac{3}{x^3} + 1$
 - C. $3^x + 1$
 - D. $3\sqrt{x} + 1$

4. Which of the following may represent the graph of the equation $x - 2y + 1 = 0$?

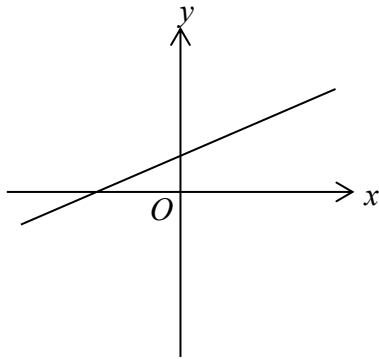
A.



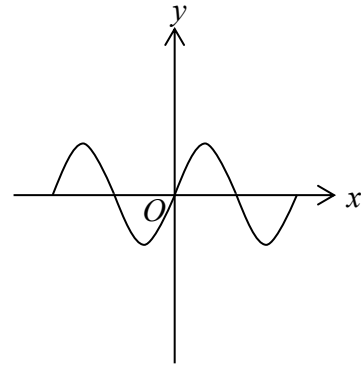
B.



C.



D.



5. There are 20 students from a school joining a camp. Each student is expected to pay \$ x . If 3 of them withdraw from the camp, each remaining student has to pay \$15 more. Which of the following equations can be used to find the value of x ?

A. $20x = 17(x - 15)$

B. $20x = 17(x + 15)$

C. $20x = 23(x + 15)$

D. $20(x - 15) = 17x$

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

A. $x + 9 < y + 9$

B. $x - 9 < y - 9$

C. $-9x < -9y$

D. $\frac{x}{9} < \frac{y}{9}$

7. The weight of a pack of marshmallows is 50 g (correct to the nearest g). Which of the following could be its actual weight?

A. 49.4 g

B. 49.7 g

C. 50.5 g

D. 50.8 g

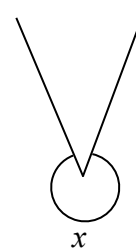
8. In the figure, x is

A. an acute angle.

B. an obtuse angle.

C. a straight angle.

D. a reflex angle.



9. Which of the following product information shows the capacity of an electronic water heater with the most suitable unit and degree of accuracy?

A.

Product Information
 Product: Electronic Water Heater
 Capacity: 15 111 mL

B.

Product Information
 Product: Electronic Water Heater
 Capacity: 15.111 L

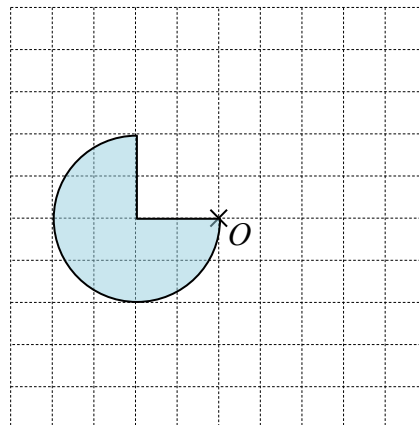
C.

Product Information
 Product: Electronic Water Heater
 Capacity: 15 000 mL

D.

Product Information
 Product: Electronic Water Heater
 Capacity: 15 L

10.

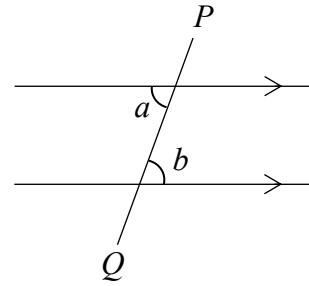


Will the size and shape of the above figure be changed after rotating about O through 90° in a clockwise direction?

	Size	Shape
A.	unchanged	unchanged
B.	unchanged	changed
C.	changed	changed
D.	changed	unchanged

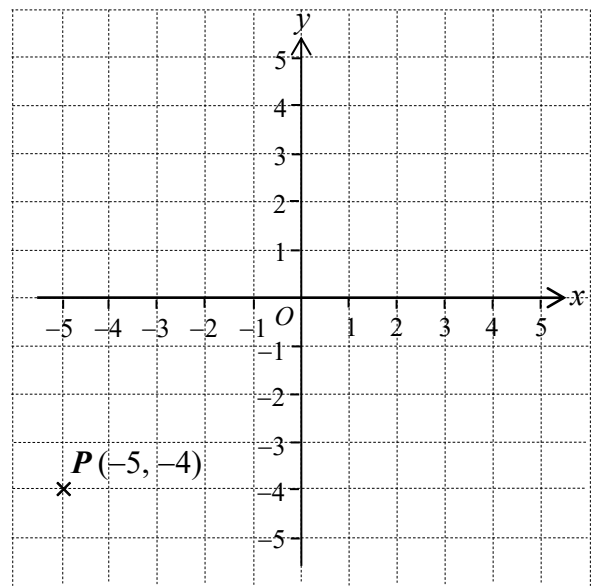
11. In the figure, PQ is a straight line. a and b are

- A. alternate angles.
- B. interior angles on the same side.
- C. corresponding angles.
- D. angles at a point.



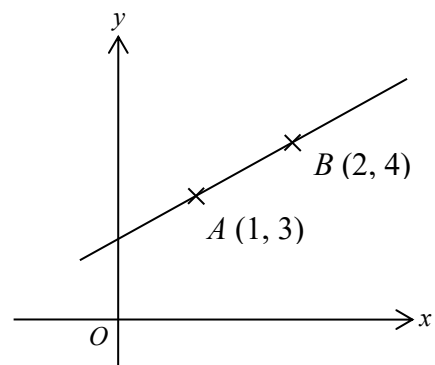
12. In the figure, $P(-5, -4)$ is rotated about the origin O through 270° in a clockwise direction to P' . Find the coordinates of P' .

- A. $(-5, 4)$
- B. $(-4, 5)$
- C. $(4, -5)$
- D. $(5, -4)$



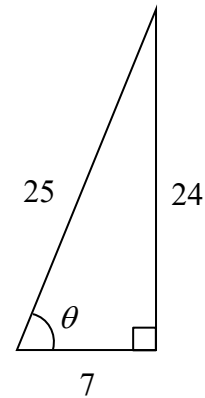
13. $A(1, 3)$ and $B(2, 4)$ are two points in the rectangular coordinate plane. The coordinates of the mid-point of AB are

- A. $(1-2, 3-4)$.
- B. $(1+2, 3+4)$.
- C. $\left(\frac{1-2}{2}, \frac{3-4}{2}\right)$.
- D. $\left(\frac{1+2}{2}, \frac{3+4}{2}\right)$.



14. Find the value of $\sin\theta$ in the figure.

- A. $\frac{24}{7}$
- B. $\frac{24}{25}$
- C. $\frac{25}{24}$
- D. $\frac{7}{25}$



15. The Marine Department would like to know how many ships pass through the harbour during peak hour. Which of the following is the most suitable method to collect data?

- A. Conduct a survey of some sailors using questionnaires.
- B. Search for information of past marine accidents in the harbour from websites.
- C. Interview people randomly at the pier.
- D. Use monitoring equipment to record the number of ships passing through the harbour.

16. Determine whether to estimate or to compute the exact value in each of the following situations.

- (i) A bus driver recorded the number of bus stops on a bus route.
- (ii) The bus company measured the distance between Tsuen Wan terminal and Kwun Tong terminal of a bus route.

	(i)	(ii)
A.	To estimate	To compute the exact value
B.	To estimate	To estimate
C.	To compute the exact value	To compute the exact value
D.	To compute the exact value	To estimate

17. Kathy has some red beans and some mung beans. The weight of the red beans is 250 g. The weight of the mung beans is 50 g lighter than that of the red beans. Find the ratio of the weight of the red beans to the weight of the mung beans.

- A. 4 : 5
- B. 5 : 1
- C. 5 : 4
- D. 5 : 6

18. Which of the following polynomials has like terms?

- A. $2ab + 7ab$
- B. $4a^2 - b^2$
- C. $3a + 3b$
- D. $5a^2 - 7a$

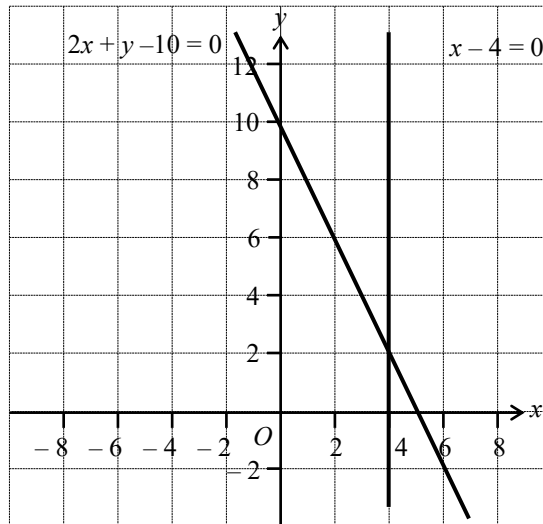
19. Simplify $w^5 \left(\frac{1}{w} \right)^3$.

- A. $\frac{1}{w^3}$
- B. $\frac{1}{w^2}$
- C. w^2
- D. w^{12}

20. Which of the following points lies on the straight line $x + y - 2 = 0$?

- A. $(4, -2)$
- B. $(0, -2)$
- C. $(-2, 0)$
- D. $(-2, -4)$

21.

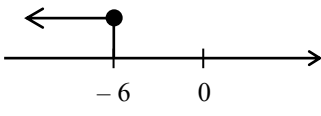
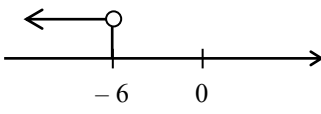
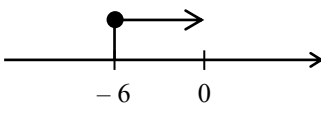
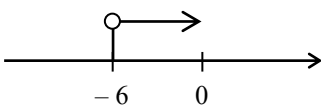


The above figure shows the graphs of $2x + y - 10 = 0$ and $x - 4 = 0$.

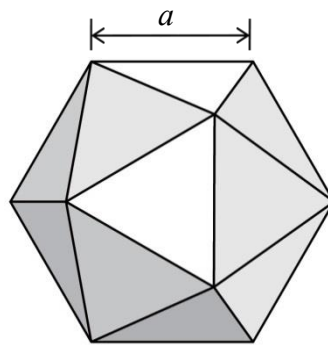
According to the given graphs, solve the simultaneous equations $\begin{cases} 2x + y - 10 = 0 \\ x - 4 = 0 \end{cases}$ graphically.

- A. $(0, 10)$
- B. $(4, 0)$
- C. $(4, 2)$
- D. $(2, 4)$

22. Which of the following diagrams represents $x \leq -6$?

- A. 
- B. 
- C. 
- D. 

23.

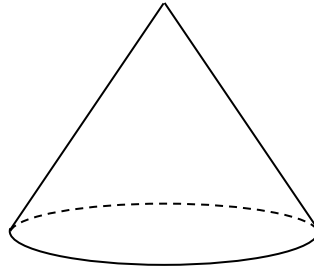


The solid in the figure is a regular icosahedron. Each of its side lengths is a .

By considering the **dimensions**, determine which of the following could express the total surface area of the above figure.

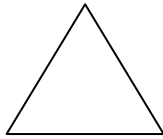
- A. $\frac{(1+\sqrt{5})}{4}a$
- B. $\frac{\sqrt{10+2\sqrt{5}}}{4}a$
- C. $5\sqrt{3}a^2$
- D. $\frac{5(3+\sqrt{5})}{12}a^3$

24. A right circular cone is placed horizontally as shown. Dennis sketches a cross-section which is parallel to the base.

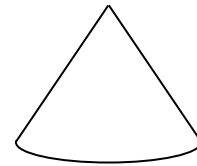


Which of the following could express the plane diagram of the cross-section?

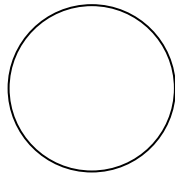
A.



B.



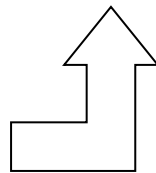
C.



D.



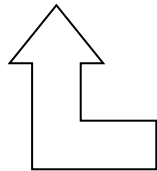
- 25.



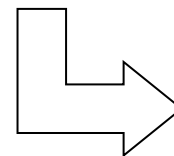
X ————— Y

Find the image of the above figure after reflecting along the straight line XY .

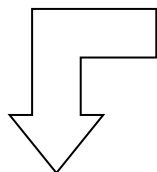
A.



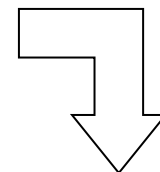
B.



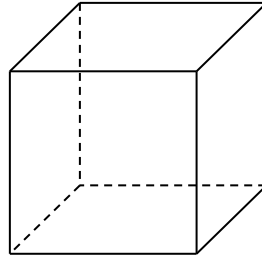
C.



D.

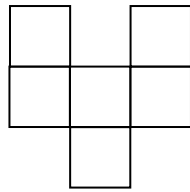


26.

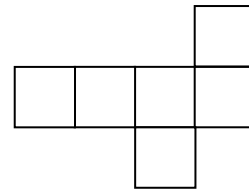


Which of the following nets can be folded into the cube above?

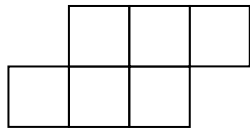
A.



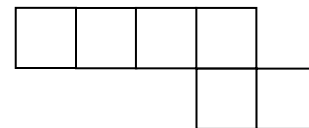
B.



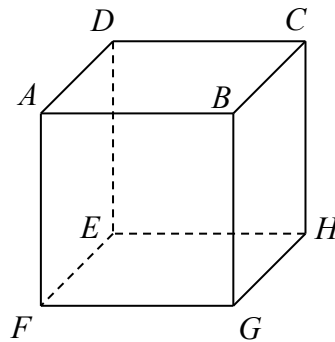
C.



D.



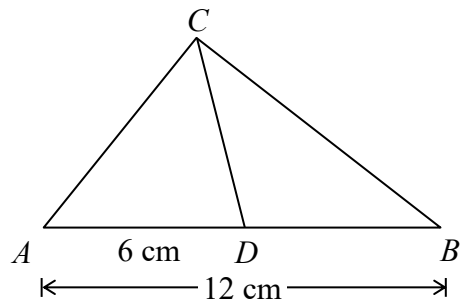
27. The figure shows a cube $ABCDEFGH$. Which of the following is a plane of reflectional symmetry of the cube?



- A. $ABCD$
- B. $BCEF$
- C. $ABGF$
- D. $ADEF$

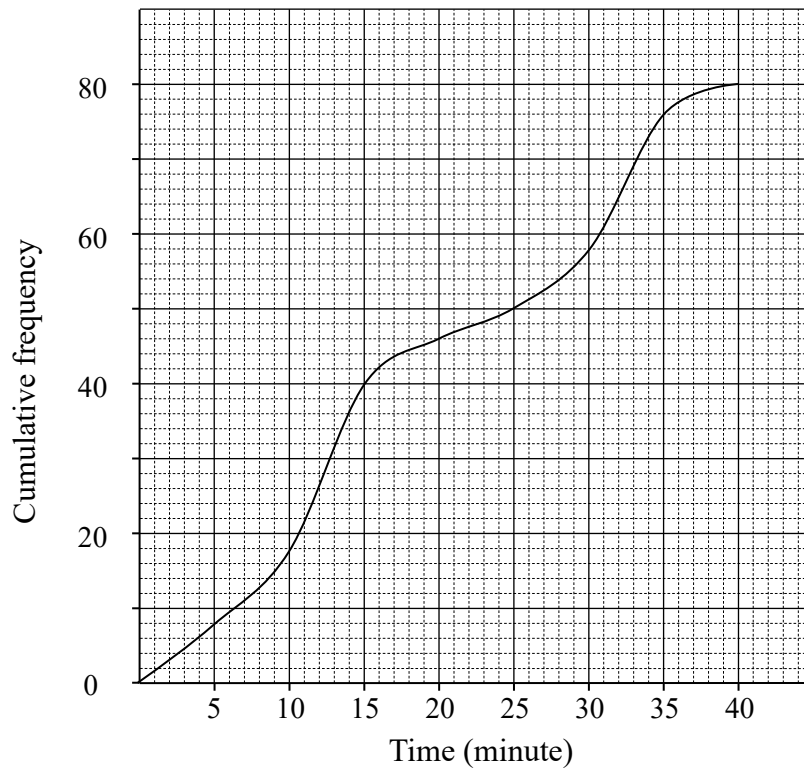
28. In $\triangle ABC$, D is a point on AB . $AD = 6$ cm and $AB = 12$ cm. CD **MUST** be

- A. a perpendicular bisector of $\triangle ABC$.
- B. an angle bisector of $\triangle ABC$.
- C. a median of $\triangle ABC$.
- D. an altitude of $\triangle ABC$.



29. The cumulative frequency curve below shows the waiting times (minute) of 80 patients in a clinic.

Waiting times of 80 patients



Find the median of the waiting times of the 80 patients.

- A. 15 minutes
- B. 20 minutes
- C. 40 minutes
- D. 46 minutes

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

30. A board game used directed numbers to represent the number of squares in which the chequer jumps forwards and backwards.

For example, -5 represents that the chequer jumps 5 squares backwards.

Use a directed number to represent each of the following situations:

- (i) The red chequer jumps 6 squares forwards.
- (ii) The green chequer jumps 1 square backwards.

31. Round off 0.043 786 to 2 decimal places.

32. Expand $(x - 1)(x + 3)$.

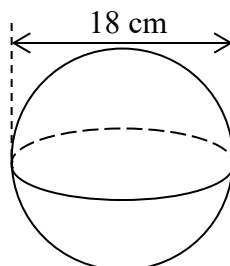
33. Factorize $4x^2 + 4x + 1$.

34. Simplify $\frac{x}{3} + \frac{x}{6}$.

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

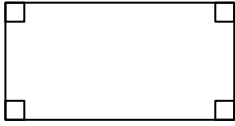
$$-\frac{3}{10} \quad \boxed{} \quad -\frac{5}{10}$$

36. The figure shows a sphere of diameter 18 cm. Find the volume of the sphere. Express the answer in terms of π .

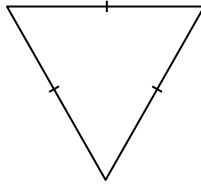


37. Which of the following polygons **MUST** be equiangular? (May be more than one answer)

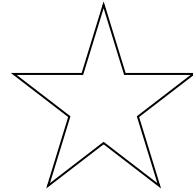
P.



Q.

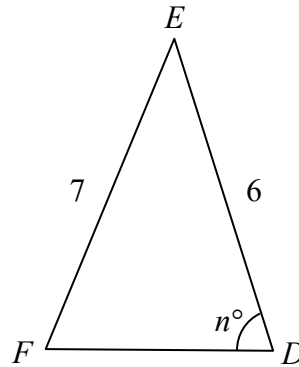
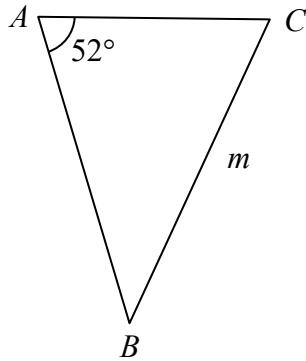


R.

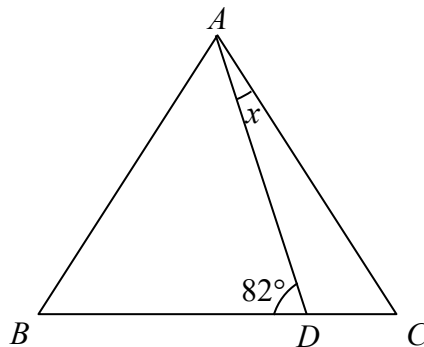


38. In the figure, $\triangle ABC \cong \triangle DEF$. Find

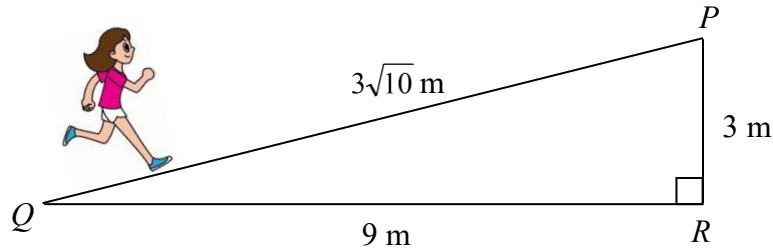
- (a) the value of m ,
- (b) the value of n .



39. In the figure, $\triangle ABC$ is an equilateral triangle. It is given that $\angle ADB = 82^\circ$, find x .



40. Macy walks upwards along a path PQ of length $3\sqrt{10}$ m . If the vertical distance PR is 3 m and the horizontal distance QR is 9 m , find the gradient of the path PQ .



41. The following data show the weights of 15 students. (Correct to the nearest kg)

45	52	63	47	66
55	46	49	69	54
57	43	60	45	50

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

42. The table below shows the number of volunteering hours of 35 students last year.

Number of volunteering hours	0 – 9	10 – 19	20 – 29	30 – 39
Number of Students	10	12	9	4

Find the modal class of the number of volunteering hours of the 35 students last year.

43. Round off 70 690 to 3 significant figures.

44. Find the values of x and y in the following sequence of triangular numbers.

$$1, 3, 6, 10, 15, 21, x, y, \dots$$

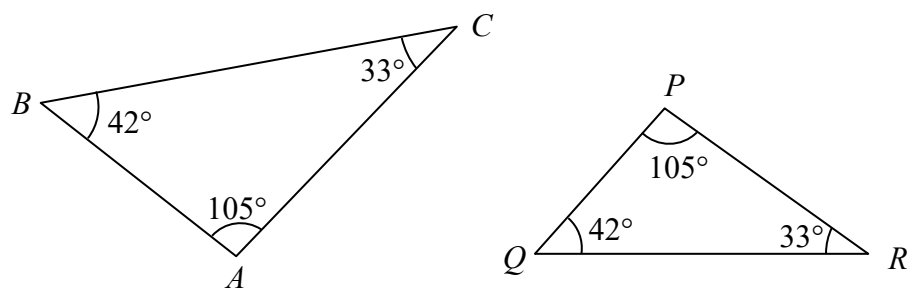
45. Expand $2x(x^2 - 1)$.

46. Factorize $x^2 + x - 6$.

47. Expand $(x - 1)(x + 1)$.

48. Consider the formula $\frac{a}{3} + \frac{5}{b} = \frac{c}{4}$. If $b = 5$ and $c = 8$, find the value of a .

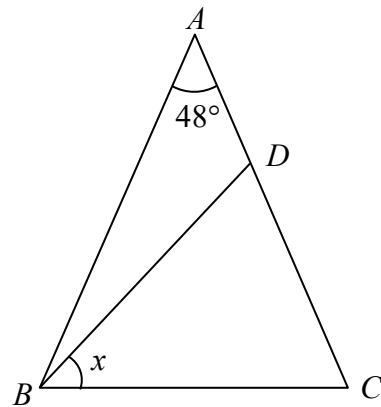
49.



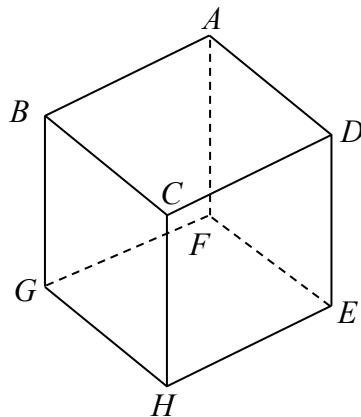
According to the given information in the above figure,

- identify whether $\triangle ABC$ and $\triangle PQR$ are congruent or similar triangles, and
- choose the correct reason.

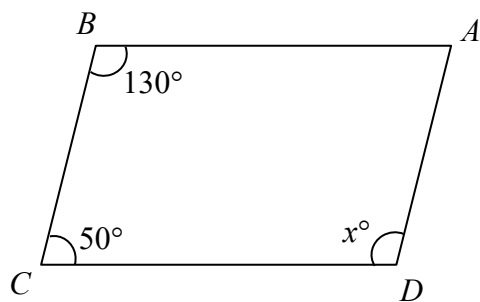
50. In the figure, ADC is a straight line. $\triangle ABC$ and $\triangle BCD$ are isosceles triangles. It is given that $AB = AC$, $BC = BD$ and $\angle BAC = 48^\circ$. Find x .



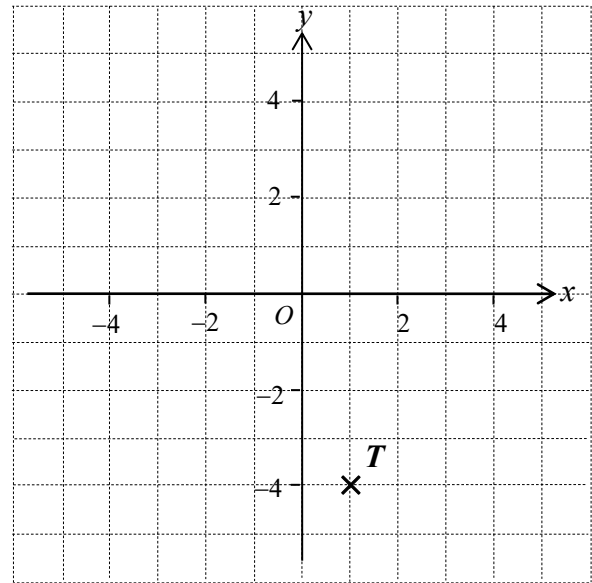
51. The figure shows a cube $ABCDEFGH$. Name the angle between the plane $ADEF$ and the horizontal plane $ABCD$.



52. In the figure, $ABCD$ is a parallelogram. $\angle ABC = 130^\circ$ and $\angle BCD = 50^\circ$. Find the value of x .



53. Find the coordinates of point T in the figure.



54. Find the distance between two points $A(-3, -4)$ and $B(2, 8)$ in the rectangular coordinate plane.

55. A secondary school is doing a survey on the number of hours spent on exercise by students in the last week. The survey is conducted in the following four stages.

- (1) According to the organised data, construct suitable statistical charts.
- (2) Organise the data obtained from questionnaires.
- (3) Analyse the data and the statistical charts to draw conclusions.
- (4) Give questionnaires about the number of hours spent on exercise in the last week to all students of the school.

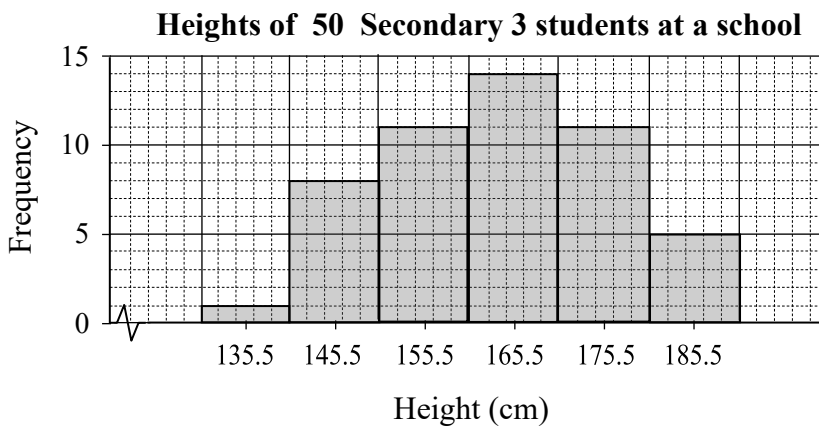
Arrange these stages in correct order. For example: $(1) \rightarrow (2) \rightarrow (3) \rightarrow (4)$

56. Vincent applied for a post in a company and he participated in the relevant assessments. The following table shows the weight of each marking item and his marks in these items.

	Assessment Item		
	Qualification	Interview Performance	Written Test
Mark	75	55	85
Weight	30%	50%	20%

Find the weighted mean mark of Vincent.

57. The histogram below shows the heights (cm) of 50 Secondary 3 students at a school.



According to the above histogram, answer the following questions.

- Complete the frequency distribution table in the **ANSWER BOOKLET**.
 - If the height of a student is not less than 170.5 cm, the student can be the basketball team member. How many students can be basketball team members?
 - If there are only 14 students shorter than David, which group should the height of David belong to?
58. There is one red, one blue and one green ball in the bag. Jack draws a ball from the bag randomly and then puts it back into the bag. He repeats the process 100 times and records the colours which are shown as follows.

Colour	Red	Blue	Green
Frequency	31	33	36

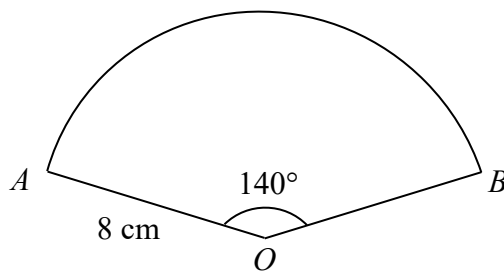
Find the empirical probability that Jack draws a red ball from the bag.

59. An electrical fan is sold at 12% off, and the selling price is \$968. Find the marked price of the electrical fan.

60. (a) Simplify $x^7 \cdot x^{-5}$ and express the answer with positive index.

(b) Simplify $(x^7 \cdot x^{-5})^3$ and express the answer with positive index.

61. In the figure, the radius of sector OAB is 8 cm and $\angle AOB = 140^\circ$. Find the area of the sector. Give the answer correct to 3 significant figures.

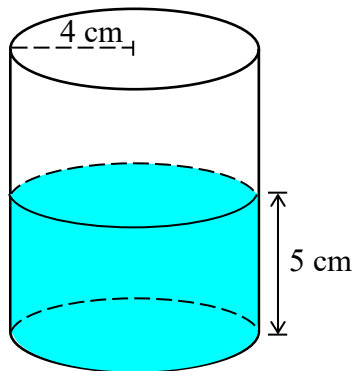


62. The following data show the studying times (hour) of 15 students in the last week.

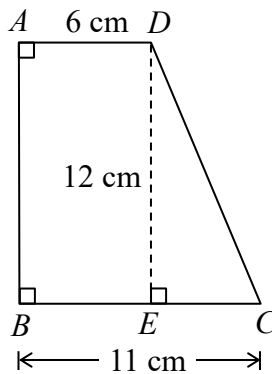
15	12	25	24	32
44	46	18	13	23
34	20	50	41	33

Complete the stem-and-leaf diagram in the **ANSWER BOOKLET** to represent the above data.

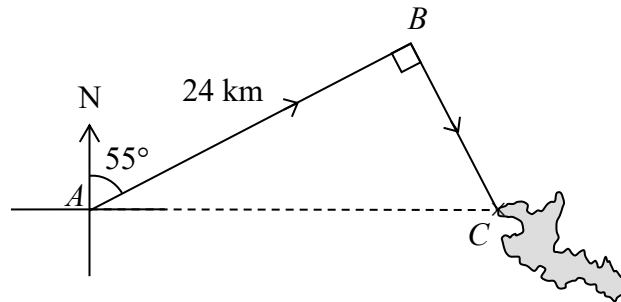
63. Catherine deposits \$2 900 in a bank. The **simple interest rate** is 3% p.a. How long will it take Catherine to receive interest of \$435?
64. Three years ago, the annual income of a football team was \$560 000 . If the annual income of the team is increased by 15% per year, find the annual income of the team this year.
65. A cylindrical vessel with a base radius of 4 cm contains water 5 cm deep. Find the volume of water in the vessel. Express the answer in terms of π .



66. In the figure, $ABCD$ is a trapezium. DE is the height of the trapezium. $\angle ABC$ and $\angle BAD$ are right angles. $AD = 6$ cm , $BC = 11$ cm and $DE = 12$ cm . Find DC .



67. In the figure, a helicopter flies from point A to point B . The distance between A and B is 24 km. The compass bearing of B from A is $N55^\circ E$. The helicopter then turns 90° to its right and flies to point C . It is given that point C is due east of point A , find the distance between A and C . (Correct to 3 significant figures)



68. The table below shows the browsing time (hour) on the Internet of 30 students in the last week.

Time (hour)	6 – 10	11 – 15	16 – 20	21 – 25
Frequency	6	7	13	4

- (a) According to the above table, complete the frequency distribution table in the **ANSWER BOOKLET**.
- (b) Find the mean browsing time on the Internet of the 30 students.

END OF PAPER