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# Education Bureau
# Territory-wide System Assessment 2021
# 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 | = | $\pi rl$ |
| | 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. Below shows a multiplication of fractions, where $N$ is a **2-digit even number**. Which of the following **CAN** be the product?

$$\frac{1}{2} \times \frac{1}{N}$$

A. $\frac{1}{2}$

B. $\frac{1}{20}$

C. $\frac{1}{22}$

D. $\frac{1}{200}$

2. Susan has a container of capacity $y$ mL and an empty bottle of capacity 500 mL. She fills up the container with water and pours all the water in the container into the bottle 10 times. If the bottle does not overflow, what is the capacity of the bottle left?

A. $(10y - 500)$ mL

B. $(500 - 10y)$ mL

C. $\left(\frac{500}{y} - 10\right)$ mL

D. $\left(\frac{500 - y}{10}\right)$ mL

3. Which of the following is **NOT** a polynomial ?

A. $m^3 - \frac{1}{6}$

B. $m^3 - 6m$

C. $m^3 - \frac{m}{6}$

D. $m^3 - \frac{6}{m}$

4. $(-2)^4 =$

A. $-8$ .

B. $8$ .

C. $-16$ .

D. $16$ .

5. Determine whether each of the following is factorization or expansion.

| | | | |
|---|---|---|---|
| (i) | $(x-1)(x+3)(x-5)$<br>$= x^3 - 3x^2 - 13x + 15$ | (ii) | $x^3 - 3x^2 - 13x + 15$<br>$= (x-1)(x+3)(x-5)$ |

A. (i) Expansion (ii) Factorization

B. (i) Expansion (ii) Expansion

C. (i) Factorization (ii) Factorization

D. (i) Factorization (ii) Expansion

6. Which of the following statements is correct?

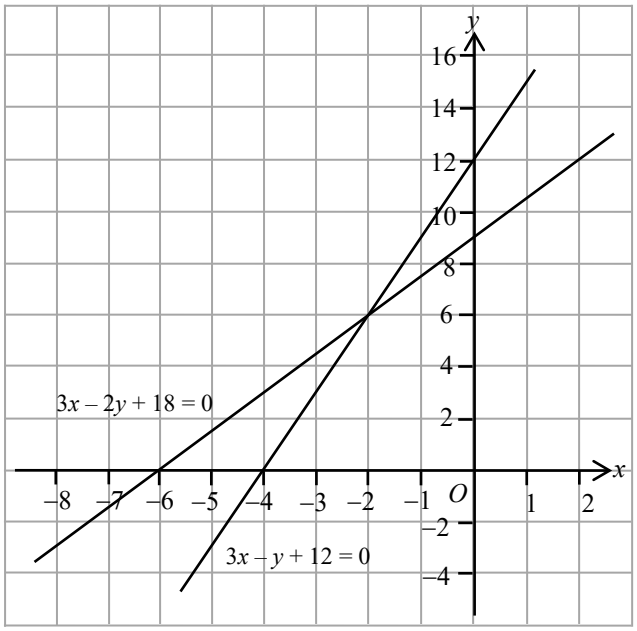
A. $-1$ is the root of the equation $x - 1 = 0$.

B. $2$ is the root of the equation $x - 2 = 0$.

C. $\frac{1}{3}$ is the root of the equation $x - 3 = 0$.

D. $-\frac{1}{4}$ is the root of the equation $x - 4 = 0$.

7.




The above figure shows the graphs of $3x - 2y + 18 = 0$ and $3x - y + 12 = 0$.

According to the given graphs, solve the simultaneous equations $\begin{cases} 3x - 2y + 18 = 0 \\ 3x - y + 12 = 0 \end{cases}$ graphically.

A. (6, –2)

B. (0, 9)

C. (–2, 6)

D. (– 4, 0)

8. Carmen spent $x$ hours practising piano last week. Her practising time on the piano this week was 3 times that of last week. If her total practising time on the piano in these two weeks was **less than** 50 hours, which of the following inequalities can be used to find the range of values of $x$ ?

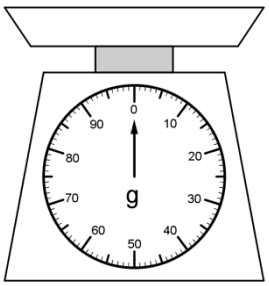
A. $x + 3x < 50$

B. $x + 3x \leq 50$

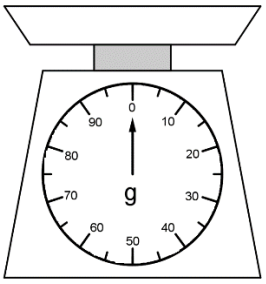
C. $x + \frac{x}{3} < 50$

D. $x + \frac{x}{3} \leq 50$

9.




Scale $A$




Scale $B$

The above figure shows Scale $A$ and Scale $B$ with different graduations. Ceci wants to find the weight of a pushpin  . Which of the following methods is **the best**?

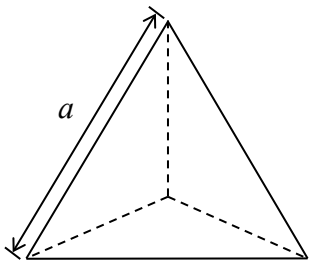
A. Ceci uses Scale $A$ to measure the weight of a pushpin.

B. Ceci uses Scale $B$ to measure the weight of a pushpin.

C. Ceci uses Scale $A$ to measure the total weight of $50$ pushpins and then divides the total weight by $50$.

D. Ceci uses Scale $B$ to measure the total weight of $50$ pushpins and then divides the total weight by $50$.

10.




The solid in the figure is a regular tetrahedron. Each of its side length is $a$.

By considering the **dimensions**, which of the following could be expressed by $\sqrt{3}a^2$?

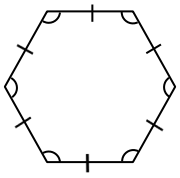
A. Total sum of the lengths of the solid

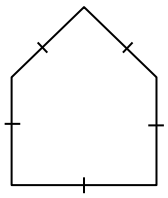
B. Height of the solid

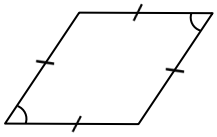
C. Total surface area of the solid

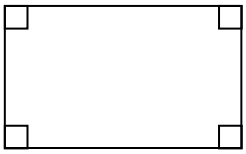
D. Volume of the solid

11. Which of the following figures can represent a regular polygon?

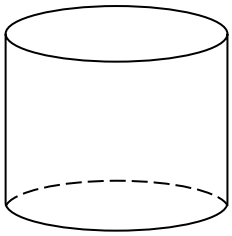
A. 

B. 

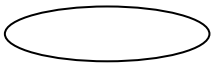
C. 

D. 

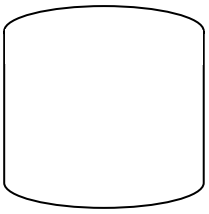
12. A right circular cylinder is placed horizontally as shown. David sketches a cross-section which is parallel to the base.

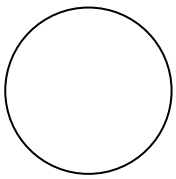


Which of the following could express the plane diagram of the cross-section?

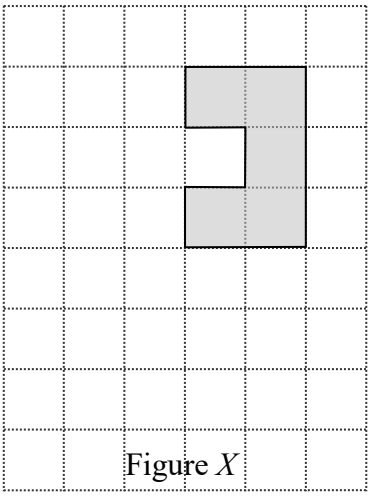
A. 

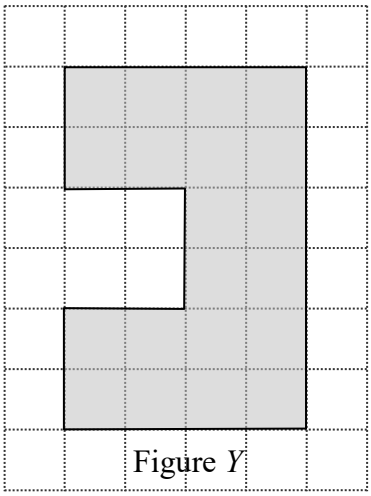
B. 

C. 

D. 

13. Figure $X$ is changed to Figure $Y$ after a single transformation. What is the corresponding transformation?




A. Enlargement

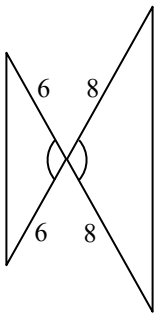
B. Translation

C. Reflection

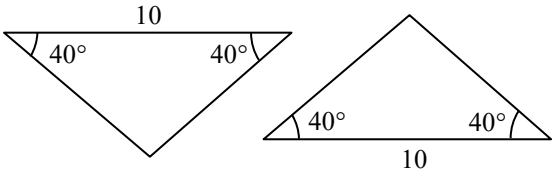
D. Rotation

14. Which of the following pairs of triangles **MUST** be congruent?

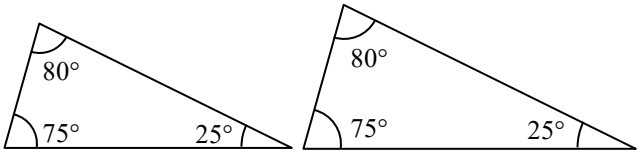
A.



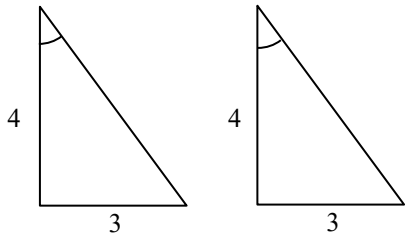

B.




C.

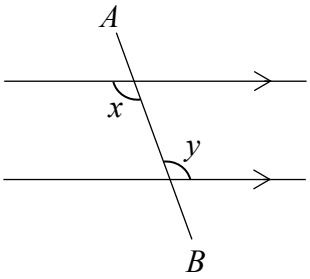



D.

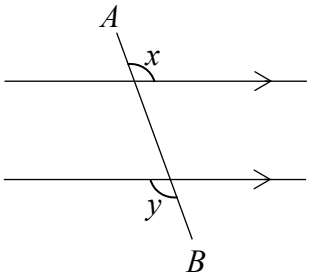


15. In each of the following figures, $AB$ is a straight line. Which figure shows that $x$ and $y$ are a pair of interior angles on the same side of a transversal?

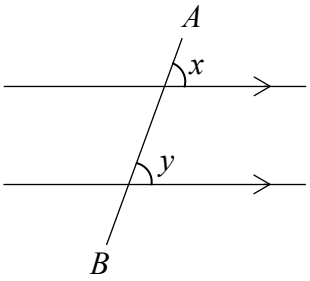
A.



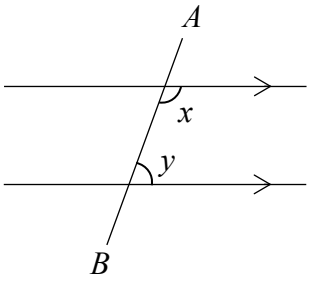

B.



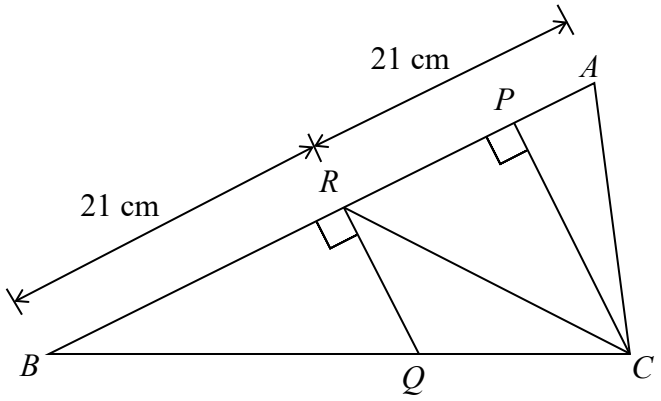

C.




D.




16. In the figure, $BQC$ and $APRB$ are straight lines. In $\triangle ABC$, $AR = RB = 21$ cm. $QR \perp AB$ and $CP \perp AB$. Which of the following is an altitude of $\triangle ABC$?



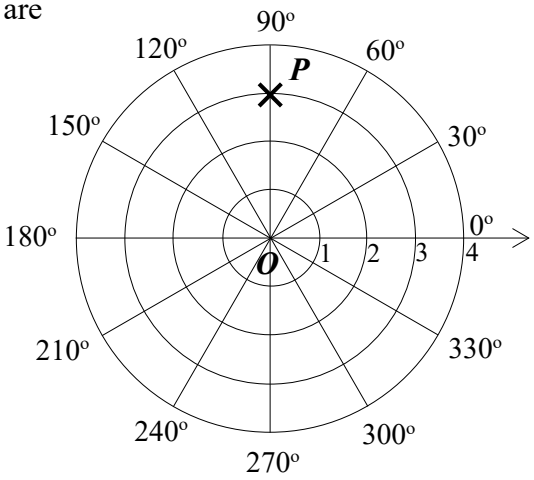

A. $CP$

B. $CR$

C. $QR$

D. $AC$

17. In the figure, the polar coordinates of point $\boldsymbol{P}$ are



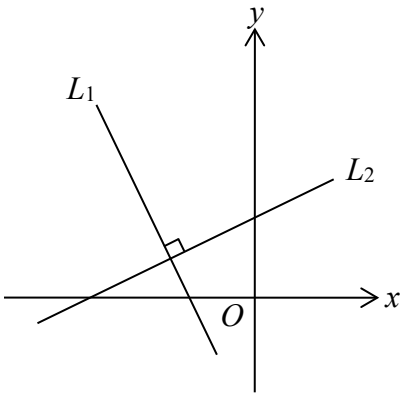

A. $(3, 0)$ .

B. $(0, 3)$ .

C. $(3, 90°)$ .

D. $(90°, 3)$ .

18. In the figure, the slope of line $L_1$ is $-2$ . Line $L_2$ is perpendicular to $L_1$ .
Find the slope of $L_2$ .




A. 2

B. $-2$

C. $\frac{1}{2}$

D. $-\frac{1}{2}$

19. The following table shows the distribution of Jacky's monthly expenditure.

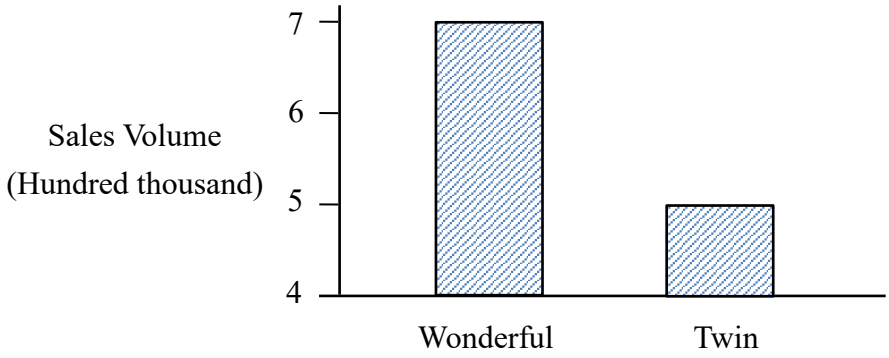
| Item | Transport | Entertainment | Food Dieting | Mortgage Payment | Others |
|---|---|---|---|---|---|
| Expenditure ($) | $1 000 | $3 000 | $8 000 | $15 000 | $2 000 |

Which of the following is the most suitable for presenting the data above?

A. Cumulative frequency curve
B. Scatter diagram
C. Stem-and-leaf diagram
D. Pie chart

20. The diagram below shows the sales of Wonderful Toothpaste and Twin Toothpaste in 2020.

**Sales of Wonderful Toothpaste and Twin Toothpaste in 2020**




Based on the diagram above, Mrs Cheung believes that the sales of Wonderful Toothpaste are 3 times that of Twin Toothpaste in 2020.
Which of the following statements is the best reason that Mrs Cheung is **misled** by the above diagrams?

A. The prices of the two brands of toothpaste are not shown.
B. The scale of vertical axis in the diagram does not start from 0.
C. There is no comparison of the sales of other brands of toothpaste.
D. The scale of the horizontal axis in the diagram does not show in values.

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

21. Calculate $\dfrac{-12}{-4-(-8)}$.

22. Round off $51.073\,4$ to $2$ decimal places.

23. A scientific formula is given as follows:

$$I = \frac{V}{r+R}$$

If $I = 4$, $V = 20$ and $R = 3$, find the value of $r$.

24. Figure 1 to Figure 4 consist of 1, 2, 3 and 4 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 $x(x + y + 1)$.

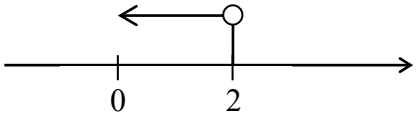
26. Factorize $y(x + 1) - 3(x + 1)$.

27. Solve the equation $\dfrac{8-x}{3} = x$.

28. Expand $(5x + 1)^2$.

29. Simplify $\frac{y}{5} \times \frac{1}{4y^2}$.

30. According to the diagram, write down an inequality in $x$.




31. The area of a circle is $361\pi$ cm$^2$, find its radius.

32. In the following figures, Figure $A$ and Figure $B$ are formed by $9$ identical equilateral triangles respectively. $4$ triangles in Figure $B$ are shaded with the same colour as shown. Write down the numbers of axes of symmetry of Figure $A$ and Figure $B$.

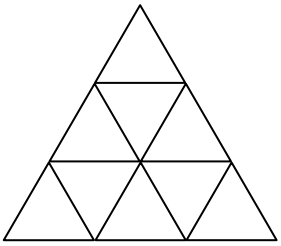


Figure $A$

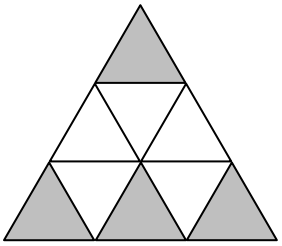
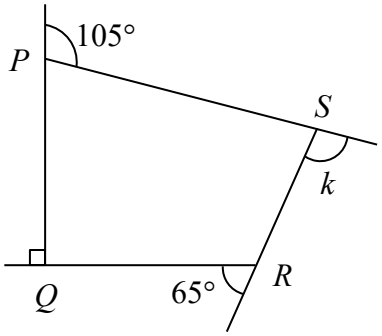


Figure $B$

33. The figure shows the exterior angles of a quadrilateral $PQRS$. Find $k$.



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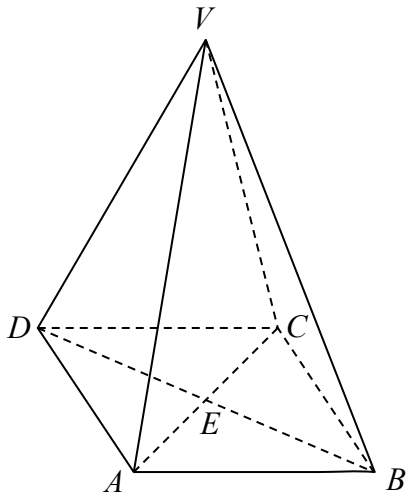
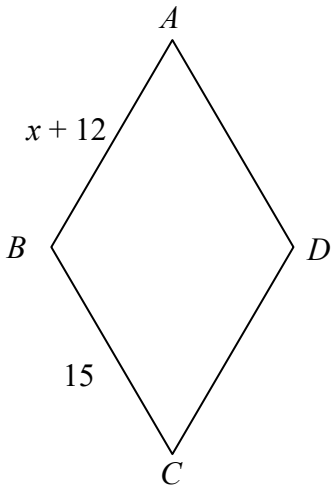
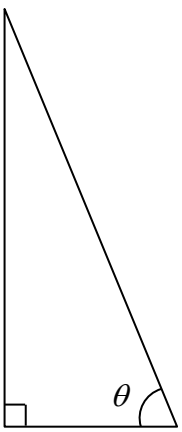
34. $VABCD$ is a right pyramid with a square base $ABCD$. $ABCD$ is a horizontal plane. $E$ is the point of intersection of $AC$ and $BD$. Name the angle between $VD$ and the plane $ABCD$.




35. In the figure, $ABCD$ is a rhombus. Find the value of $x$.




36. In the figure, $\cos\theta = 0.32$. Find $\theta$. (Correct to 3 significant figures)



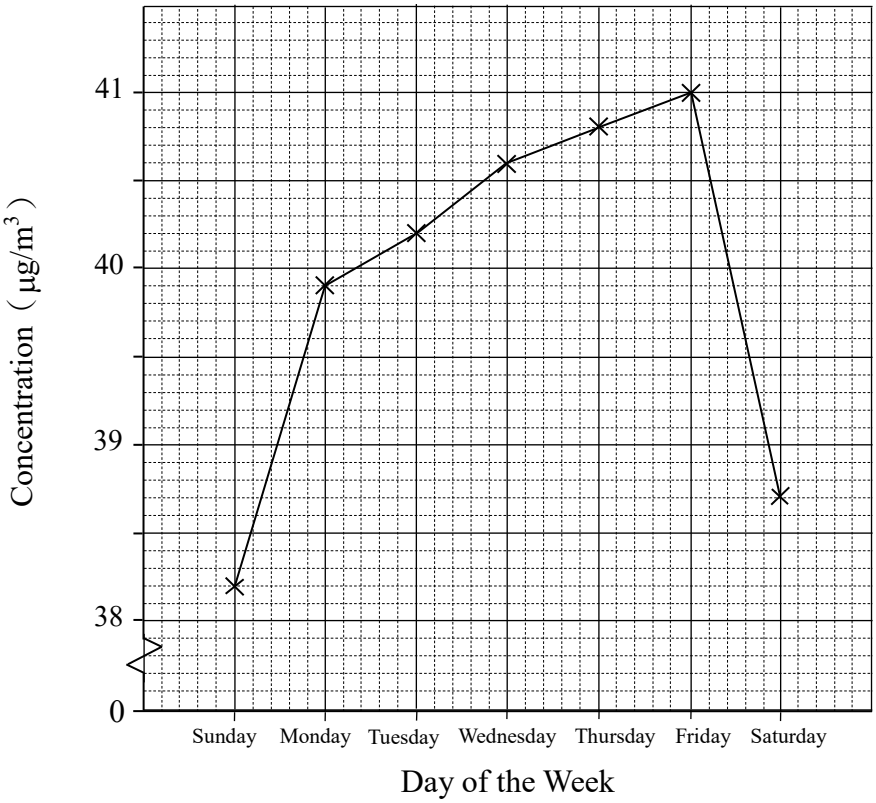
37. Mr Chan is going to analyse the Secondary 3 test results of each subject of this academic year. The survey is conducted in the following four stages.

(1) Collect the test results of each class from each subject teacher who teaches Secondary 3 this academic year.
(2) Analyse the data and the statistical charts to draw conclusions.
(3) According to the organised data, construct suitable statistical charts.
(4) Organise the marks obtained from each class and subject.

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

38. The broken line graph below shows the pollutant concentrations of nitrogen dioxide (μg/m$^3$) recorded at Kwun Tong monitoring station last week.

**Concentrations of nitrogen dioxide recorded at Kwun Tong monitoring station last week**




According to the above broken line graph, answer the following questions.

(a) How many days was the concentration of nitrogen dioxide higher than 40 μg/m$^3$ last week?

(b) On which two consecutive days did the concentration of nitrogen dioxide increase most last week?

(c) What was the difference between the concentration of nitrogen dioxide recorded on Friday and Saturday?

39. The following data show the number of sit-ups done by 5 students in one minute.

21, 28, 30, 24, 27

Find the mean and the median of the above data.

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. Jimmy deposits \$20 000 in a bank. The interest rate is 3% p.a. **compounded** yearly. Find the amount he will receive after 2 years.

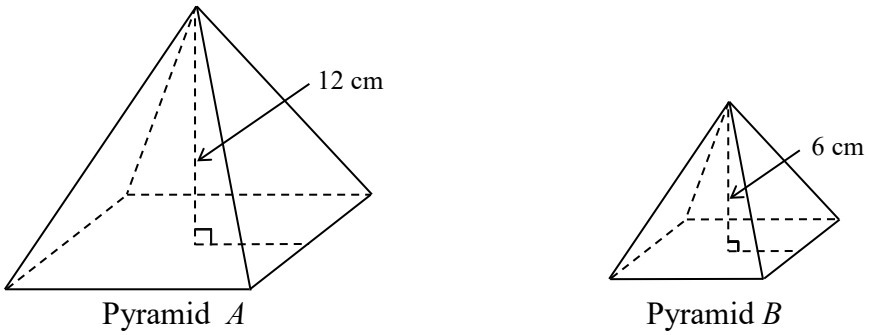
41. Jacky is a tutor in a tutorial school. His wage is \$130 / hour. He got \$2 340 for his salary this week. How many hours did he work at the tutorial school this week?

42. Complete the table for the equation $y = \frac{x}{4} - 1$ in the **ANSWER BOOKLET**.

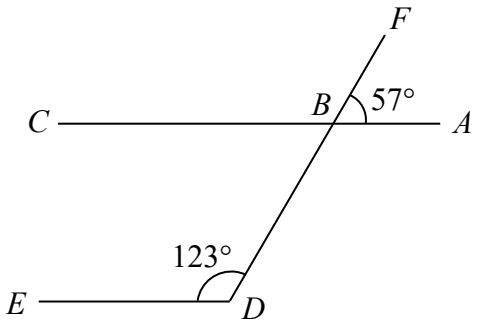
| $x$ | $-4$ | 0 | 4 |
|---|---|---|---|
| $y$ | | $-1$ | |

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

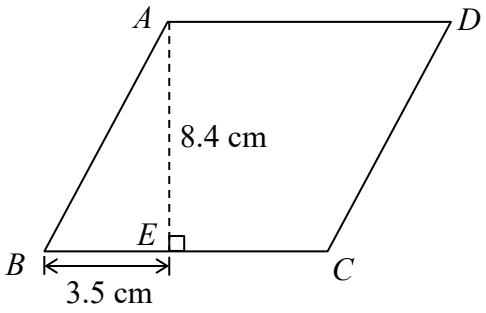
43. In the figure, Pyramid $A$ and Pyramid $B$ are similar solids. Their heights are 12 cm and 6 cm respectively. The total surface area of Pyramid $A$ is 128 $cm^2$. Find the total surface area of Pyramid $B$.



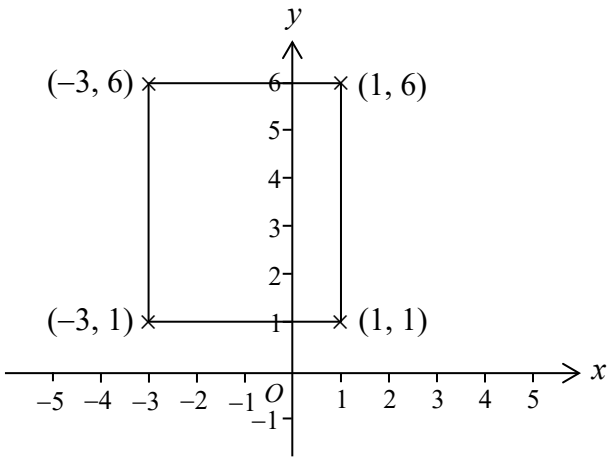

44. In the figure, $ABC$ and $FBD$ are straight lines. $\angle FBA = 57°$ and $\angle FDE = 123°$.
Prove that $AC // DE$.




45. In the figure, $ABCD$ is a parallelogram. $AE$ is the height of the parallelogram. $AE = 8.4$ cm and $BE = 3.5$ cm. Find $AB$.



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




47. All Secondary One students at a school must join one sport activity and one music activity. Students can choose long-distance running (L) or basketball (B) for the sport activities. They can choose choir (C), violin class (V) or recorder class (R) for the music activities.

(a) Some of the possible outcomes are given in the table provided in the **ANSWER BOOKLET**. Fill the remaining ones in the blanks.

(b) If Alice is a Secondary One student of the school, she chooses one sport activity and one music activity randomly. Find the probability that she chooses basketball and violin class.

END OF PAPER

**Do not write on this page.**

**Answers written on this page will not be marked.**