1 **(a)** Given that $3^{27} \div 27^3 = 3^k$, find k.

Answer k = ... [1]

(b) Simplify $\dfrac{4x^{-4}}{y^{-\frac{4}{3}}} \times \dfrac{y^{\frac{2}{3}}}{18} \div \dfrac{1}{27}$, leaving your answers in positive indices.

Answer .... [2]

2 The curve below has an equation $y = x^n + c$. State a possible value of n and the value of c.
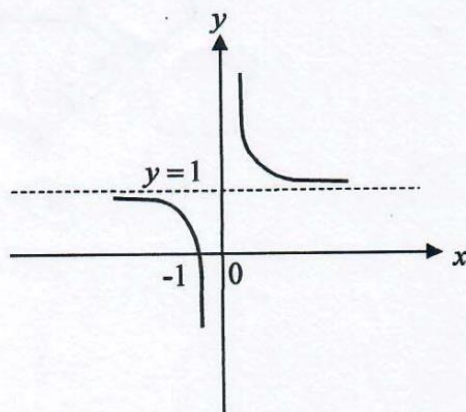
Answer n = ...

c = ... [2]

3   Jasmin has 240 two-centimetre cubes. She arranges all of the cubes into a cuboid. The perimeter of the base of the cuboid is 40 cm. Each side of the cuboid has a length greater than 4 cm. Find the height of the cuboid.
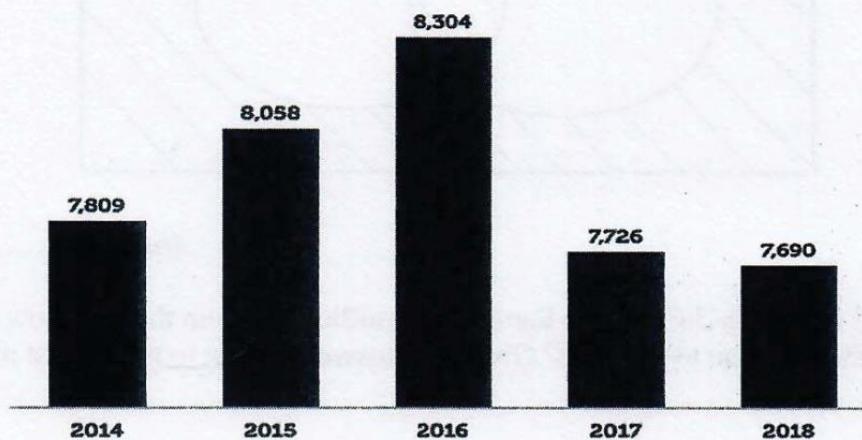
Answer ....cm [2]

4   Violet intends to arrange n regular pentagons in a ring. The diagram shows the partially completed ring.
Find n.
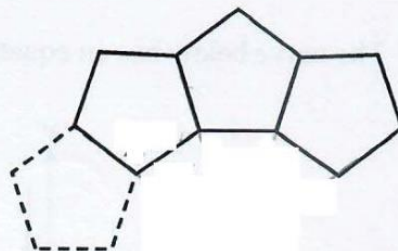
Answer n = ... [3]

5. The bar chart shows the number of traffic accidents resulting in injury from 2014 to 2018.
(https://www.budgetdirect.com.sg/car-insurance/research/road-accident-statistics-in-singapore)

Number of Accidents Resulting in Injuries (2014 – 2018)

8,304

8,058

7,809

7,726

7,690

2014   2015   2016   2017   2018

State how this bar chart can be misleading to the reader.

....

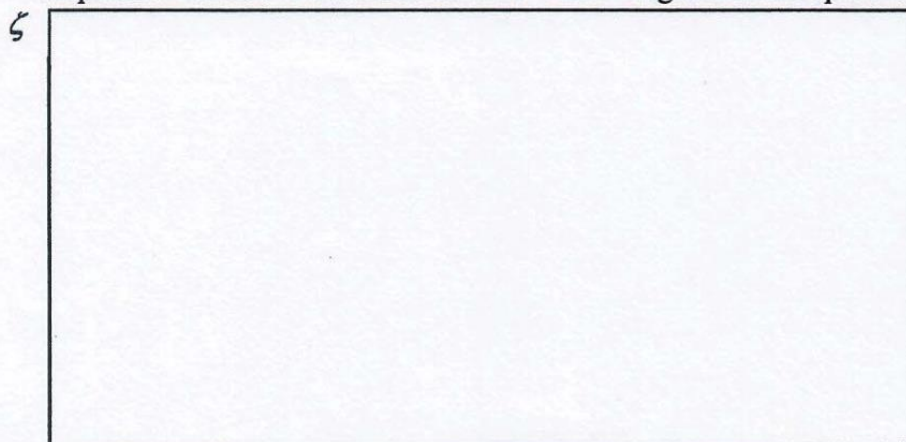.. [1]

6. (a) Given that $\zeta = \{$all triangles$\}$, $R = \{$right-angled triangles$\}$
and $S = \{$triangles with three unequal sides$\}$

A is a triangle with 45°, 45° and 90°.
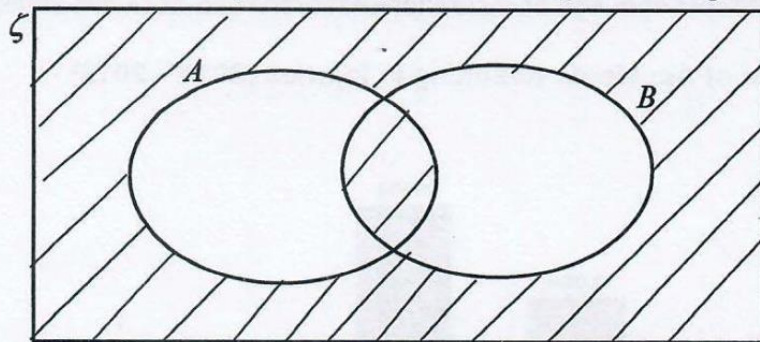B is a triangle with 7 cm, 7 cm and 3 cm.
C is a triangle with sides 9 cm, 12 cm and 15 cm.

Represent the above information on a Venn Diagram in the space below.

ζ

[2]

(b) Write down the set represented by the following shaded regions.

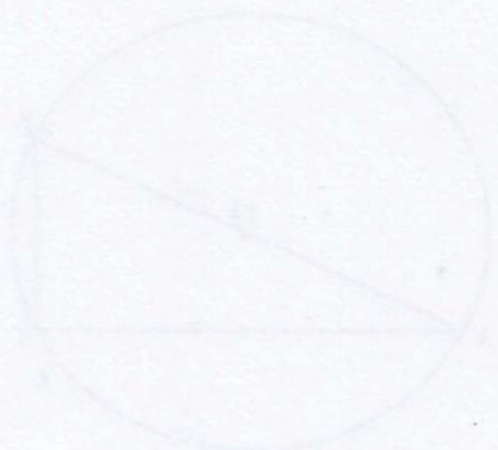*Answer* .... [1]

7   The speed of light is 3×10^8 m/s. Earth is 150 million km from the sun. How long does light take to travel from the sun to the earth? Give your answer, correct to the nearest minute.

Answer ....minutes [2]

8   A maximum quadratic curve with the equation $y=-x^2+bx+c$ has a turning point at $(3,7)$, find the value of b and of c.

Answer b = ... and *c =* .... [3]

9   Solve the equation $\dfrac{1}{x+1} - \dfrac{6x^2-10}{1-x^2} = 4$.

Answer x = ... or *x* = ... [4]

10   Simplify $\dfrac{27-12x^2}{-3-2x^2+5x} \times \dfrac{1-x}{-2x-3}$.

Answer .... [3]

11 In the diagram below, XZ is the chord of a circle. XY is the diameter of the circle, centre O.
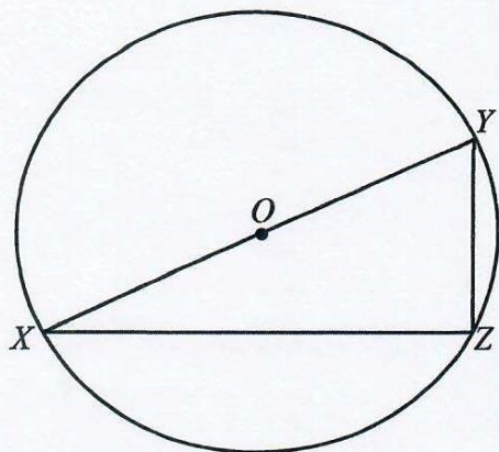
Given that $XZ = 9$ cm and $YZ = \sqrt{63}$ cm, calculate

(a) the length of XY,

Answer ....cm [1]

(b) $\angle YXZ$,

Answer .... ° [1]

(c) $\angle YOZ$ in radian,

Answer ....rad [2]

(d) the area of the major segment YXZ.

Answer ....cm² [3]

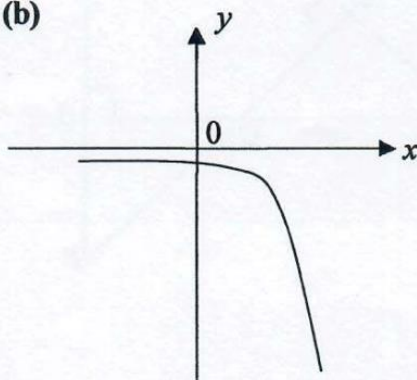| $y = x^3 - 4$ | $y = -3(4)^x$ | $y = 4 - x^2$ | $y = 4x^{-2}$ |
| $y = -2x^{-4}$ | $y = 4 - x^3$ | $y = -3(-4)^x$ | $y = x^2 + 4$ |

Write down a possible equation for each of the sketch graphs below.
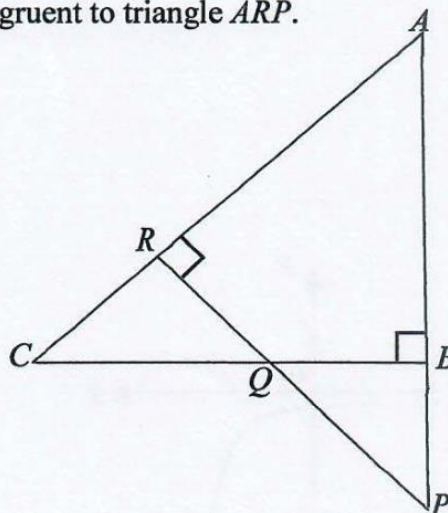In each case select one of the equations from the box above.

(a)
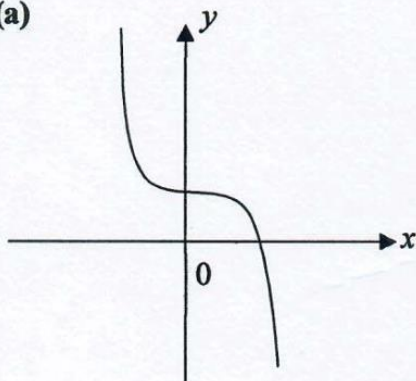
Answer …..………………….. [1]

(b)

Answer …..…………………….. [1]

13 Make x the subject in the equation $y = \sqrt{x^2 - 8x + 16 - y^2}$.

Answer x = ... [3]

14 In the diagram shown below, it is given that $AP = 5$ cm, $BP = 2$ cm and $AR = 3$ cm. ARC, ABP and RQP are straight lines.
Show, with clear reasons, that triangle ABC is congruent to triangle ARP.

Answer

[2]

15 A lake has an actual area of 2.5 km². The area of the lake on the map is 40 cm². The distance between two towns on the map is 45 cm. Find the actual distance, in kilometres, between the two towns.

Answer ....km [3]

16 **(a)** Solve the inequalities $\dfrac{8x-12}{2} \le 3x+1 < \dfrac{17x}{3}$.

Answer .... [3]

(b) Hence, write down all the prime numbers that satisfy $\dfrac{8x-12}{2} \le 3x+1 < \dfrac{17x}{3}$.

Answer .... [1]

17   Factorise completely $4x^2 - 12xy + 9y^2 - 1$

18   The Venn diagram shows the elements of ξ and three sets A, B and C.
      $\xi = \{x: x \text{ is a positive integer such that } 0 < x < 14\}$
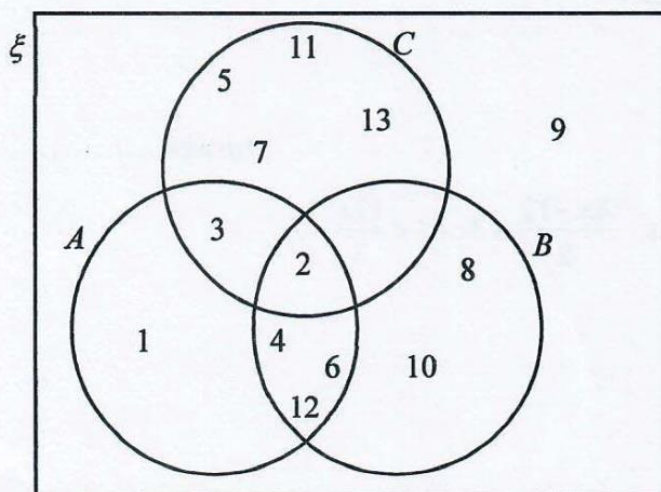
(a)   Describe in words the elements in set C.

Answer

.... [1]

(b)   Use one of the symbols below to complete each statement.

$$\varnothing \quad \subset \quad \not\subset \quad \notin \quad \in \quad \xi$$

(i) $A' \cap (B \cap C) = $ ....

(ii)   3   .... A [1]

19 The time taken to assemble a car is inversely proportional to the number of workers involved. 4 workers can complete the assembly in x days. If 6 more workers are involved, the assembly can be completed 3 days in advance.

(a) Find the value of x.

Answer $x =$ .... [2]

(b) Find the number of workers required if the assembly is to be completed in 2 days.

Answer .... [2]

20 In the figure, $ABCD$ is a quadrilateral. The point X is such that XB and XD are the angle bisectors of angle ABC and angle ADC respectively.

Reflex angle $BCD = 200°$ and reflex angle $BXD = 225°$.
Calculate angle BAD.
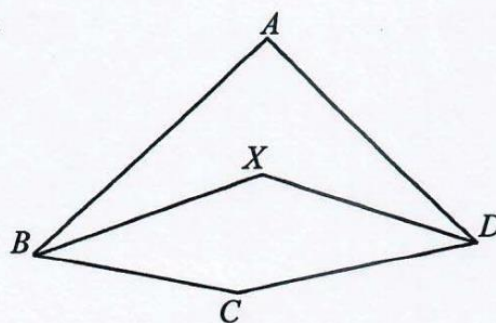
Answer .... ° [4]

21   (a)   An open container in a shape of an inverted cone has radius of 10 cm and height of 30 cm. Water is poured into the container at a constant rate of 5π cm³/s until it is completely filled to the brim.
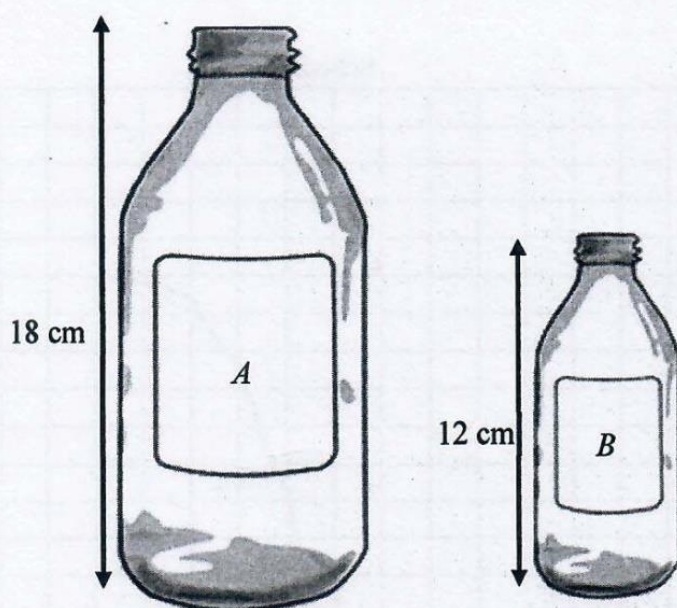Find the time taken for the container to be completely filled.

Answer ....s [1]

(b)   Sketch the graph of the water-level against time below.

Height (cm)

0   → Time (s)
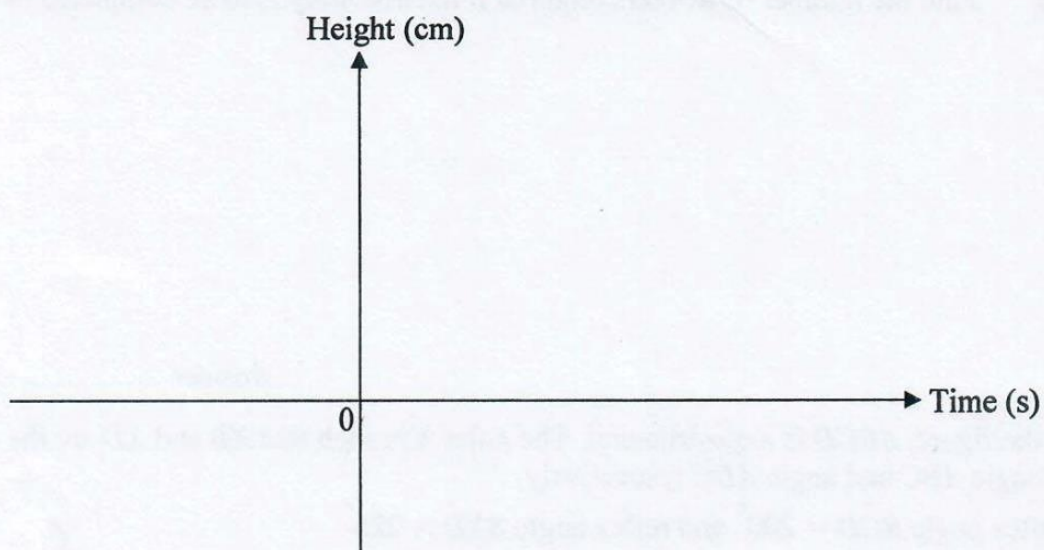
[1]

22   A popular drink is produced in two similar bottle sizes. The height of the large bottle A is 18 cm while the height of the smaller bottle B is 12 cm.


18 cm

A

12 cm

B

If the selling prices of bottles A and B are $24.90 and $6.90 respectively, which bottle provides better value for money? Justify your answer clearly.

Answer

[3]

23 The cumulative frequency diagram shows the times taken by 200 girls from school A running 2.4 km test. The box-and-whisker plot shows the times for another group of girls from school B.

Cumulative Frequency

School A

Timing in minutes

School B

Timing in minutes
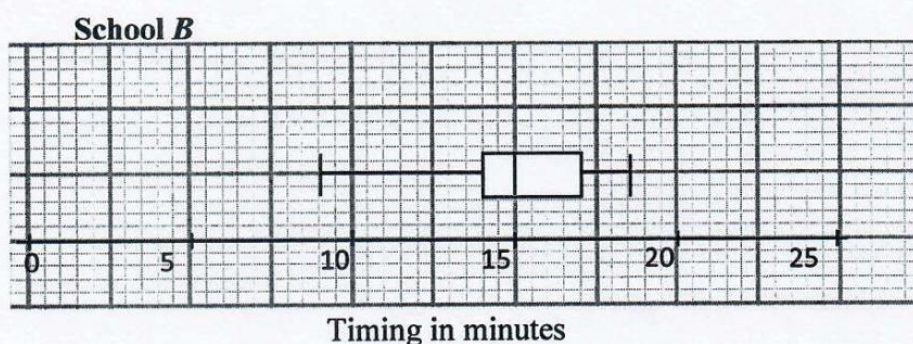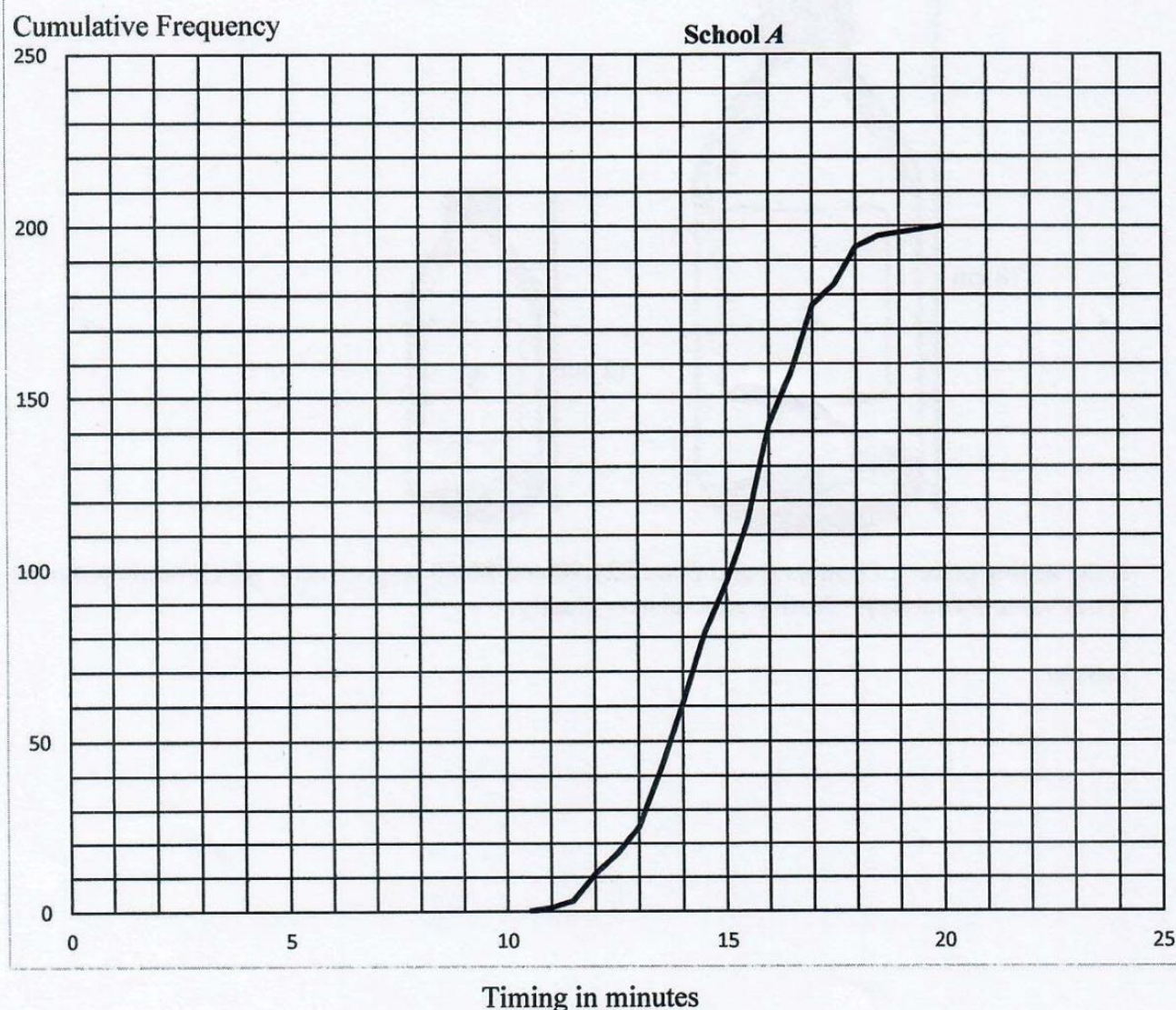
(a) 75% of the girls in school B failed the test. If the passing time is the same for both schools, find the number of girls who passed in school A.

Answer .... [1]

(b) 30% of the girls in school A took longer than t minutes. Find t.

Answer .... [2]
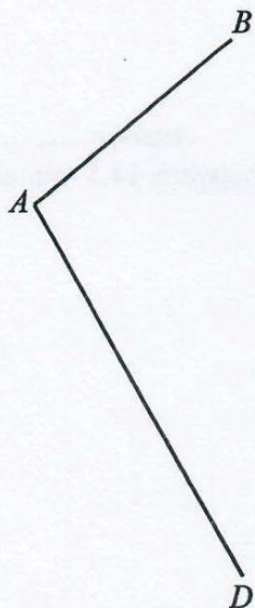
(c) Find the percentage of girls in school A who took between 14.5 minutes and 17 minutes to complete the run.

Answer .... [2]

24 (a) Construct kite *ABCD*. *AB* and *AD* have already been drawn.
Measure and state the length of the longest diagonal.

Answer

B

A

D

Answer ....cm [2]

(b) Construct the perpendicular bisector *AD*. [1]

(c) Construct the bisector of the angle *BAD*. [1]

(d) *ABCD* represents a plot of land which is to be used for a park. A café is to be built in park, nearer to *A* than to *D* and nearer to *AD* than *AB*. Shade the region where the café is to be built. [1]

25 Ahmad and Beng Hai want to rent lockers in school. The lockers are in two levels. Lockers 1A to 1C are on the lower level and Lockers 2A to 2C are on the next level. Lockers are assigned to each student randomly.

(a) Using a possibility diagram, represent the two lockers that the two boys can be allocated.
Answer

[2]
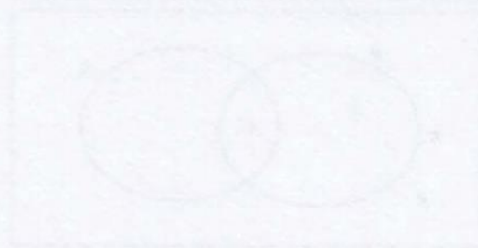
(b) Find the probability that Ahmad and Beng Hai are randomly allocated lockers next to each other on Level 2.

Answer .... [1]

(c) Find the probability that Ahmad and Beng Hai are randomly allocated lockers on different levels.

Answer .... [1]

(d) If the locker 2C was not available, find the probability that the friends will be allocated lockers next to each other at any level.

Answer .... [2]

End of Paper