## SPM MODEL PAPER

### Paper 1

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1** | A | **11** | D | **21** | D | **31** | D |
| **2** | D | **12** | C | **22** | B | **32** | D |
| **3** | D | **13** | A | **23** | C | **33** | B |
| **4** | B | **14** | A | **24** | B | **34** | C |
| **5** | C | **15** | D | **25** | C | **35** | D |
| **6** | A | **16** | C | **26** | D | **36** | D |
| **7** | C | **17** | A | **27** | A | **37** | B |
| **8** | B | **18** | A | **28** | D | **38** | A |
| **9** | C | **19** | C | **29** | C | **39** | D |
| **10** | C | **20** | B | **30** | A | **40** | D |

**1 A** $0.360423 = 0.360$ (3 s.f.)

**2 D** I, II and IV

| | |
|---|---|
| I | 9.5 exabytes $= 9.5 \times 10^{18}$ bytes |
| II | 1 250 femtolitres<br>$= 1.25 \times 10^{3} \times 10^{-15}$ litre<br>$= 1.25 \times 10^{-12}$ litre |
| III | 25 decimetres $= 2.5 \times 10 \times 10^{-1}$ metres<br>$= 2.5$ metres $\neq 2.5 \times 10^{2}$ metres |
| IV | 560 metres $= (5.6 \times 10^{2}) \times 10^{9}$ nanometres<br>$= 5.6 \times 10^{11}$ nanometres |

**3 D** $0.000654 - 4.9 \times 10^{-5} = 6.54 \times 10^{-4} - 4.9 \times 10^{-5}$
$= 6.54 \times 10^{-4} - 4.9 \times 10^{-1} \times 10^{-4}$
$= (6.54 - 0.49) \times 10^{-4}$
$= 6.05 \times 10^{-4}$

**4 B** Period of interest calculation $= \frac{15}{365}$ days

Finance charge $= \text{RM}1\,200 \times \frac{15}{365} \times 18\%$
$= \text{RM}8.88$

Late payment charge $= 1\% \times (\text{RM}1\,200 + \text{RM}8.88)$
$= \text{RM}12.09$

Outstanding balance $= \text{RM}(1\,200 + 8.88 + 12.09)$
$= \text{RM}1\,220.97$

**5 C** $a > 0$ and $a < 3$
$\therefore a = 1$

**6 A** Let brother's age this year $= x$
Henry's age this year $= x + 15$
4 years ago, $(x - 4)(x + 15 - 4) = 364$
$(x - 4)(x + 11) = 364$
$x^2 + 11x - 4x - 44 - 364 = 0$
$x^2 + 7x - 408 = 0$
$(x + 24)(x - 17) = 0$
$x = 17$ ($-24$ rejected)
Therefore their total age $= (17 + 1) + (17 + 15 + 1)$
next year
$= 51$

**7 C** $3(5^2) + 4(5) + 3 = 3(25) + 20 + 3$
$= 98$

| | | |
|---|---|---|
| 8 | 98 | |
| 8 | 12 | ...2 |
| 8 | 1 | ...4 |
| | 0 | ...1 |

$98_{10} = 142_{8}$

**8 B** $10101_2 + 1010111_2 = 1101100_2$
$= 108_{10}$

| | | |
|---|---|---|
| 7 | 108 | |
| 7 | 15 | ...3 |
| 7 | 2 | ...1 |
| | 0 | ...2 |

$108_{10} = 213_{7}$

**9 C** True conclusion → Strong
True premises → Cogent

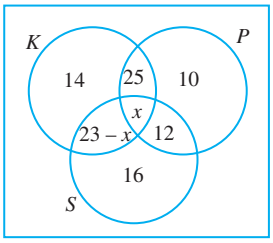
**10 C** $x = \frac{2}{3} \times 108°$
$= 72°$
$y = 180° - \angle WST$
$= 180° - \frac{1}{3}(108°)$
$= 180° - 36°$
$= 144°$

**11 D** $\angle AOB = 360° \div 3$
$= 120°$

**12 C** $x = 180° - 65°$
$= 115°$
$y = 125° - 90°$
$= 35°$
$x + 2y = 115° + 2(35°)$
$= 185°$

**13 A** $(M \cup N) \cap L'$

**14 A**

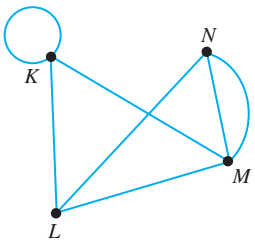



Set $K$ = basketball
Set $P$ = ping pong
Set $S$ = football

① Fill in $n(S \text{ only})$ and $n(K \text{ only})$ first
② Let $n(K \cap P \cap S) = x$
$n(K \cap S \text{ only}) = 23 - x$ and
$n(K \cap P \text{ only})$
$= n(K) - n(K \text{ only}) - n(K \cap S)$
$= 62 - 14 - 23$
$= 25$
$\therefore x = n(K \cap P) - n(K \cap P \text{ only})$
$= 30 - 25$
$= 5$
$n(P \cap S \text{ only}) = n(S) - n(S \text{ only}) - n(K \cap S)$
$= 51 - 16 - 23$
$= 12$
$\therefore n(P \text{ only}) = n(P) - n(K \cap P) - n(P \cap S \text{ only})$
$= 52 - 30 - 12$
$= 10$

**15 D** Marbles in the game of *congkak*.

**16 C**




$n(E) = 7$
$d(K) = 4$
$\sum d(v) = 2n(E)$
$= 14$
The graph produced is **not** a simple graph because there are loop and multiple edges.

**17 A** $2(x+9) > 14$ and $x - 6 \leqslant -4$
$x + 9 > 7$ $x \leqslant -4 + 6$
$x > -2$ $x \leqslant 2$


$x = -1, 0, 1, 2$

**18 A** $n(M) = 8, n(B) = x, P(B) = \frac{3}{7}$

$$\frac{x}{8+x} = \frac{3}{7}$$
$$7x = 3(8+x)$$
$$7x = 24 + 3x$$
$$4x = 24$$
$$x = 6$$

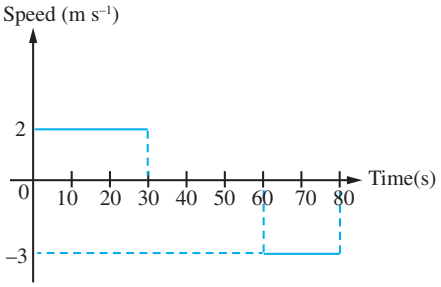
Total number of red and blue marbles $= 8 + 6$
$= 14$

**19 C** Area under the graph for Ali = Area under the graph for Ben Li

$$\frac{1}{2} \times 16 \times v = \frac{1}{2} \times [16 + (14 - 4)] \times 10$$
$$8v = 26 \times 5$$
$$v = \frac{130}{8}$$
$$= 16.25$$

**20 B** Speed of car = gradient

Gradient for the period (1 – 30) s $= \frac{60}{30}$
$= 2 \text{ m s}^{-1}$
Gradient for the period (30 – 60) s $= 0$
Gradient for the period (60 – 80) s $= -\frac{60}{20}$
$= -3 \text{ m s}^{-1}$




**21 D** Let the height of cylinder = $h$ and the height of cone = $t$
Volume of the composite solid = 6 600 cm$^2$

$$\pi r^2 h + \frac{1}{3}\pi r^2 t = 6\,600$$
$$\pi r^2 (h + \frac{1}{3}t) = 6\,600$$
$$\frac{22}{7} \times 10^2 \times (16 + \frac{1}{3}t) = 6\,600$$
$$16 + \frac{1}{3}t = \frac{6\,600}{100} \times \frac{7}{22}$$
$$\frac{1}{3}t = 21 - 16$$
$$t = 5(3)$$
$$= 15$$

Total height $= 16 + 15$
$= 31$ cm

**22 B** $\angle VUW$

**23 C** 3, 4, 4, 6, 10, 12, 12, and $x$, $y$
Mean = 7
$3 + 2(4) + 6 + 10 + 2(12) + x + y = 9(7)$
$51 + x + y = 63$
$x + y = 63 - 51$
$= 12$

Mode = 4
$\therefore x = 4, y = 8$

**24 B** $\sum f = 35$

Median

| 17 | | | 18th value | 17 | | |
|---|---|---|---|---|---|---|
| 8 | 9th value | 8 | | 8 | 27th value | 8 |
| $Q_1$ | | | | $Q_3$ | | |

$Q_3 - Q_1 = 47 - 32$
$= 15$

**25 C** Total savings needed
$= 10\%$ (RM600 000) + RM10 000
= RM70 000

Total monthly savings $= \frac{70\,000}{5 \times 12}$
= RM1 166.67

Balance of monthly income
= RM(8 200 – 5 600 – 1 166.67)
= RM1 433.33

**26 D** $n(L) = n(K \cup M)'$
$4 + 2 + 6 + 3x = 3x + x$
$x = 12$
$n(M) = 12 + 8 + 2 + 6$
$= 28$

$$P(M) = \frac{28}{28 + 10 + 4 + 4(12)}$$
$$= \frac{28}{90}$$
$$= \frac{14}{45}$$

**27 A** Buy a bungalow

**28 D** $\frac{(6x^2 - 10x - 16)}{3x - 8} = \frac{2(3x^2 - 5x - 8)}{3x - 8}$

$$= \frac{2(3x - 8)(x + 1)}{3x - 8}$$
$$= 2(x + 1)$$

**29 C** $\sqrt[3]{27x^{-9}y^3} \times x^4y^{-2} \div 6x^{-2}y^3 = \frac{(3^3x^{-9}y^3)^{\frac{1}{3}} \times x^4y^{-2}}{6x^{-2}y^3}$

$$= \frac{3x^{-3+4-(-2)}y^{1+(-2)-3}}{6}$$
$$= \frac{x^3y^{-4}}{2}$$
$$= \frac{x^3}{2y^4}$$

**30 A** $y \propto x^2$
$y = k(z + 5)^2$

$$k = \frac{12}{(1 + 5)^2}$$
$$= \frac{1}{3}$$
$$y = \frac{1}{3}x^2$$

**31 D**
$$\begin{bmatrix} x \\ 5 \end{bmatrix}[-x \quad 2] = \begin{bmatrix} -3x & 6 \\ y & 10 \end{bmatrix}$$
$$\begin{bmatrix} -x^2 & 2x \\ -5x & 10 \end{bmatrix} = \begin{bmatrix} -3x & 6 \\ y & 10 \end{bmatrix}$$
$$2x = 6$$
$$x = 3$$
$$y = -5(3)$$
$$= -15$$
$$x - y = 3 - (-15)$$
$$= 3 + 15$$
$$= 18$$

**32 D**
$$\begin{bmatrix} 1 & 1 \\ 3 & 4 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 25 \\ 90 \end{bmatrix}$$
$$\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{4-3}\begin{bmatrix} 4 & -1 \\ -3 & 1 \end{bmatrix}\begin{bmatrix} 25 \\ 90 \end{bmatrix}$$
$$= \begin{bmatrix} 100 - 90 \\ -75 + 90 \end{bmatrix}$$
$$= \begin{bmatrix} 10 \\ 15 \end{bmatrix}$$

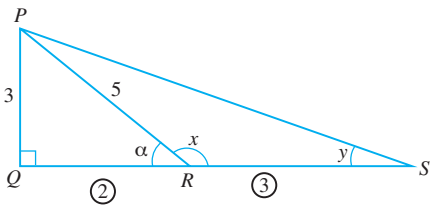
**33 B** Death

**34 C** Total insurance required = 75% × RM980 000
= RM735 000
Total compensation
$$= \frac{\text{RM680 000}}{\text{RM735 000}} \times \text{RM45 000} - \text{RM4 000}$$
= RM37 632.65

**35 D** Property assessment tax need to be paid every 6 months
$$= \frac{1}{2} \times 4\% \times \text{RM7 560}$$
= RM151.20

**36 D**
$$a = \frac{5.5 - (-0.5)}{2}$$
$$= 3$$
3 complete cycles in 360°, $b = 3$
$$c = \frac{5.5 + (-0.5)}{2}$$
$$= 2.5$$
$$\therefore y = 3\cos 3x + 2.5$$

**37 B**




$$\sin x = \sin\alpha = \frac{3}{5}$$
$QR = 4$
$$QS = \frac{5}{2} \times 4$$
$$= 10$$
$$\tan y + \cos x = \frac{3}{10} + \left(-\frac{4}{5}\right)$$
$$= -\frac{1}{2}$$

**38 A** W V
$K \rightarrow L \rightarrow M$

| | Transformation $V$ | Transformation $W$ |
|---|---|---|
| **A** | Enlargement with a scale factor, $k = 2$ at the centre (8, 2) | Reflection on the $x$-axis |

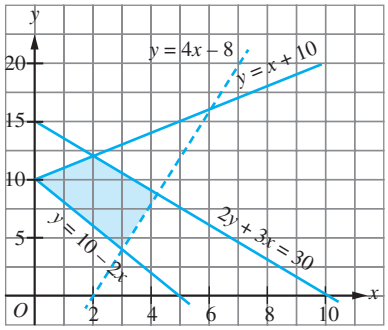
**39 D** Graph with a gradient of 2 and $y$-intercept of 3.

**40 D** Total surface area
$= 2(1.7 \times 2.7) + 2(1.7 \times 0.7) + 2(0.7 \times 2.7)$
$= 15.34\ \text{m}^2$
Cos = RM45 × 15.34
= RM690.30
Total amount payable = RM(690.30 + 80)
= RM770.30

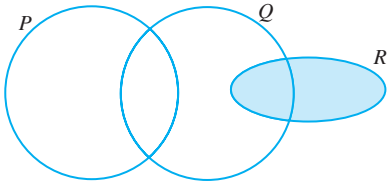
## Paper 2

### Section A

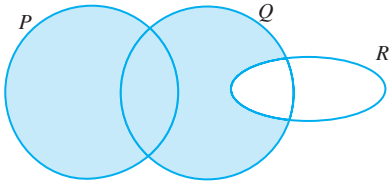
**1**



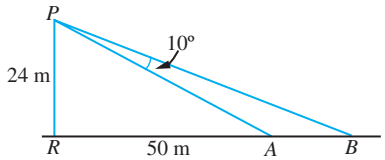

**2** (a) $P' \cap R$




(b) $(P \cap Q') \cup R'$




**3**




$$\angle APR = \tan^{-1}\frac{50}{24}$$
$$= 64.36°$$
$$\angle BPR = 64.36° + 10°$$
$$= 74.36°$$
$$\tan 74.36 = \frac{RB}{24}$$
$$RB = 24\tan 74.36°$$
$$AB + 50 = 85.73$$
$$= 35.73\ \text{m}$$

**4**
$$\begin{array}{rrrr} & 3 & 6 & 1_7 \\ + & & 5 & 2 & 4_7 \\ \hline & 1 & 2 & 1 & 5_7 \end{array}$$
$$1(7^3) + 2(7^2) + 1(7) + 5 = 453_{10}$$

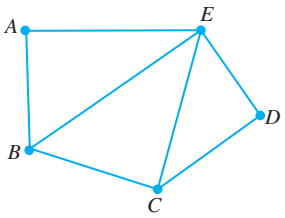
| | | |
|---|---|---|
| 8 | 453 | |
| 8 | 56 | ...5 |
| 8 | 7 | ...0 |
| | 0 | ...7 |

$453_{10} = 705_8$

**5** $n(V) = 5$ and $\sum d(v) = 14$

$2n(E) = 14$

$n(E) = 7$




*Or other graphs that fulfill the conditions given*

**6** Volume of cuboid $ABCDEFGH$ + volume of right prism $BGLKJIHC$ – volume of quarter cylinder

$= [4 \times 4 \times 8] + \left[\frac{1}{2} \times (8+4) \times (8+2) \times 4\right] - \left[\frac{1}{4} \times \frac{22}{7} \times 2^2 \times 4\right]$

$= 128 + 240 - \frac{88}{7}$

$= 355\frac{3}{7}\ \text{cm}^3$

**7** (a) $\angle APR$

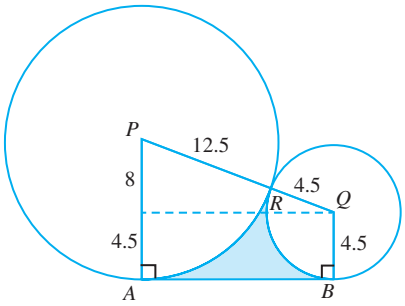
$= \cos^{-1}\frac{8}{17}$

$= 61.93°$

$\angle BQR$

$= 180° - 61.93°$

$= 118.07°$




(b) $AB$

$= \sqrt{17^2 - 8^2}$

$= 15$ cm

Area of shaded region

= Area of trapezium $ABQP$ – area of sector $PAR$ – area of sector $QBR$

$= \left[\frac{1}{2} \times (12.5 + 4.5) \times 15\right] - \left[\frac{61.93}{360} \times \frac{22}{7} \times 12.5^2\right] - \left[\frac{118.07}{360} \times \frac{22}{7} \times 4.5^2\right]$

$= 127.5 - 84.48 - 20.87$

$= 22.15\ \text{cm}^2$

**8** $\bar{x} = 65.5$

$$\frac{2(52) + 8(57) + 62x + 18(67) + 10(72) + 3(77)}{2 + 8 + x + 18 + 10 + 3} = 65.5$$

$$\frac{2\,717 + 62x}{41 + x} = 65.5$$

$2\,717 + 62x = 2\,685.5 + 65.5x$

$31.5 = 3.5x$

$x = 9$

**9** (a) Not valid because it does not comply with the valid form of deductive argument.
Not sound because the conclusion is false. Marissa might be the name of an animal.

(b) If $x$ is not the multiple of 9, then $x$ is not a multiple of 3.
False. (6 is not a multiple of 9 but it is a multiple of 3)

**10** (a) $I = Ptr$

$= \text{RM}20\,000 \times 5 \times 2.5\%$

$= \text{RM}2\,500$

(b) Matured value, $MV = P\left(1 + \frac{r}{n}\right)^{nt}$ ← $n = 12 \div 3 = 4$

$= \text{RM}20\,000\left(1 + \frac{0.024}{4}\right)^{4 \times 5}$

$= \text{RM}22\,541.85$

Total interest $= \text{RM}22\,541.85 - \text{RM}20\,000$

$= \text{RM}2\,541.85$

**Section B**

**11** (a) $\frac{1}{2} \times (x+3) \times (x+2) = x^2$

$x^2 + 5x + 6 = 2x^2$

$x^2 - 5x - 6 = 0$ (Proven)

(b) $x^2 - 5x - 6 = 0$

$(x+1)(x-6) = 0$

$x = 6$ (negative value is rejected)

(c) Total area of two shapes $= 2 \times 6^2$

$= 72\ \text{cm}^2$

(d) Length of $RQ = \sqrt{9^2 + 8^2}$

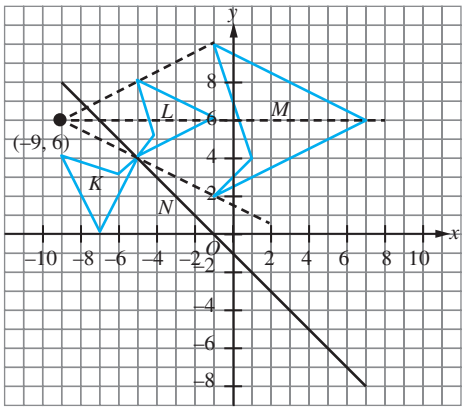
$= 12.04$ cm

Length of wire needed

$= 9 + 8 + 12.04 + 4(6)$

$= 53.04$ cm

**12**




(a) (i) $K$

(ii) $M$ ($K$ is accepted)

(b) $M \rightarrow L \rightarrow K$

**Q** **P**

(i) **Q** = Enlargement with a scale factor, $k = \frac{1}{2}$ at the centre $(-9, 6)$

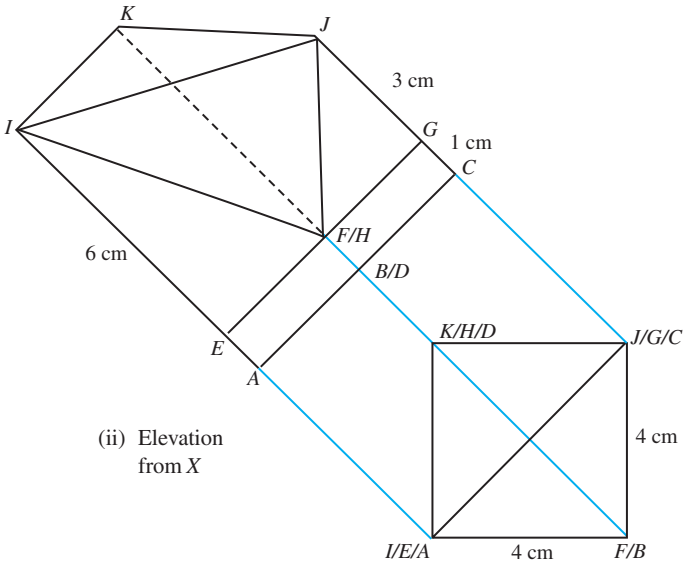
(ii) **P** = Reflection on the line $y = -x - 1$

(c) $\frac{\text{Area of image}}{\text{Area of object}} = \left(\frac{1}{2}\right)^2$

$4 \times 30$ = Area of $M$

Area of $M$ $= 120\ \text{m}^2$

**13** (a), (i), (ii)




(ii) Elevation from $X$

(b) If $= 6.7$ cm, $JF = 4.1$ cm

(i) Plan

**14** (a) Let $A = \begin{bmatrix} 4 & 6 \\ 5 & 8 \end{bmatrix}$, therefore $A^{-1} = \frac{1}{4(8) - 6(5)} \begin{bmatrix} 8 & -6 \\ -5 & 4 \end{bmatrix}$

$= \frac{1}{2} \begin{bmatrix} 8 & -6 \\ -5 & 4 \end{bmatrix}$

$= \begin{bmatrix} 4 & -3 \\ -2.5 & 2 \end{bmatrix}$

$\therefore n = -2.5$

(b) (i) Let $x$ = honeydew melon and $y$ = starfruit

$5x + 7y = 58$

$x + 4y = 22$

(ii) $\begin{bmatrix} 5 & 7 \\ 1 & 4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 58 \\ 22 \end{bmatrix}$

$\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{5(4) - 7(1)} \begin{bmatrix} 4 & -7 \\ -1 & 5 \end{bmatrix} \begin{bmatrix} 58 \\ 22 \end{bmatrix}$

$= \frac{1}{13} \begin{bmatrix} 4(58) - 7(22) \\ -1(58) + 5(22) \end{bmatrix}$

$= \frac{1}{13} \begin{bmatrix} 78 \\ 52 \end{bmatrix}$

$= \begin{bmatrix} 6 \\ 4 \end{bmatrix}$

The price of 1 kg of honeydew melon = RM6

The price of 1 kg of starfruits = RM4

**15** (a) Monthly fixed income = 10% × RM10 800

= RM1 080

(b)

**Mr Peter's Financial Plan**

| **Income and Expenditure** | **(RM)** | |
|---|---|---|
| Net salary of Mr Peter | 10 800 | |
| Passive income | 0 | |
| ***Total monthly income*** | 10 800 | |
| Minus fixed monthly savings | 1 080 | |
| Minus emergency fund | 100 | |
| ***Income balance*** | | 9 620 |
| **Minus monthly fixed expenses** | | |
| Instalment of housing loan | 2 300 | |
| Instalment of car loan (1) | 1 350 | |
| Instalment of car loan (2) | 890 | |
| Insurance premiums | 1 100 | |
| ***Total monthly fixed expenses*** | | 5 640 |
| **Minus monthly variable expenses** | | |
| Petrol and toll | 380 | |
| Utilities bill | 500 | |
| Kitchen expenditure | 1 200 | |
| Wife | 800 | |
| Children | 500 | |
| Parents | 500 | |
| ***Total monthly variable expenses*** | | 3 880 |
| **Surplus of income or Deficit** | | 100 |

(c) Total fixed savings after 6 months = 6 × RM1 080

= RM6 480

Total emergency fund = 6 × RM100

= RM600

Total surplus after 6 months = 6 × RM100

= RM600

Total savings = RM(6 480 + 600 + 600)

= RM7 680

He cannot achieve his goal. The total amount of money is not sufficient, still lack of RM2 320

He needs 8 months to achieve his goal.

## Section C

**16** (a) (i) 120 – 80 = 40 minutes

(ii) 0800 hours + 70 minutes = 0910 hours

Aizat departed from the toll plaza $A$ at 9.10 a.m.

(iii) They met at $Q$, distance from toll plaza $B$

= 200 – 100

= 100 km

(iv) Average speed $= \frac{200 \text{ km}}{\frac{180}{60} \text{ h}}$,

$= 66\frac{2}{3}$ km/h

(b) Total road tax payable by Sham

= RM280 + (1 998 – 1 800) × (RM0.50)

= RM280 + RM99

= RM379

(c) Distance between Sham's house and Aizat's house

$= \sqrt{[1 - (-3)]^2 + (6 - 3)^2}$

$= \sqrt{16 + 9}$

= 5 km

Distance between Sham's house and office = 5 km

Total daily round-trip distance = 2 × (5 + 5) km

= 20 km

Total distance travelled in June = 4 × 5 × 20 km

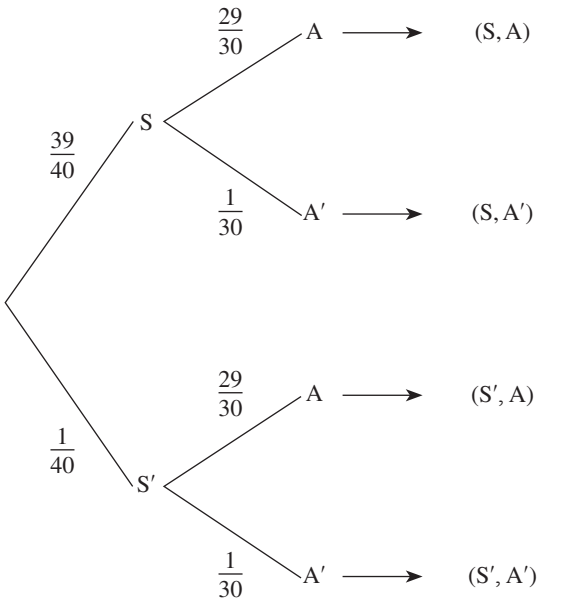
= 400 km

Total payment received by Aizat

= (50% × 400 km) × RM1.50

= RM300

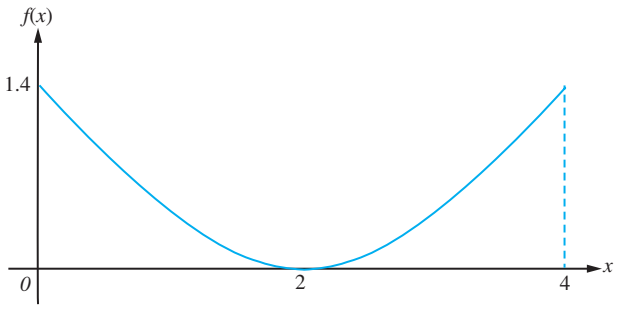
(d)




S – Sham is early or on time
S′ – Sham is late
A – Aizat is early or on time
A′ – Aizat is late

The probability that one of them is late
$= P(S, A') \text{ or } P(S', A)$
$= \frac{39}{40}\left(\frac{1}{30}\right) + \frac{1}{40}\left(\frac{29}{30}\right)$
$= \frac{17}{300}$

**17**




(a) (i) Equation of the axis of symmetry, $x = 2$

$$-\frac{b}{2a} = 2$$

$$b = -4a \text{ ..... ①}$$

Substitute (2, 0) into $f(x) = ax^2 + bx + 1.4$

$$0 = a(2)^2 + b(2) + 1.4$$

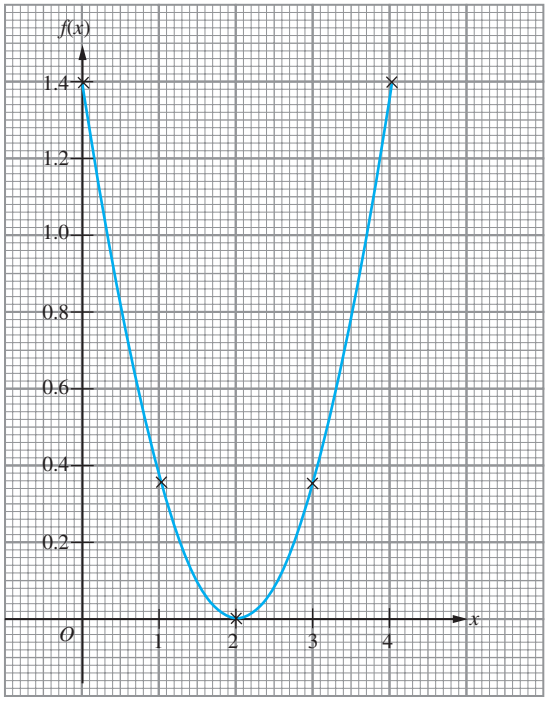
$$4a + 2b + 1.4 = 0 \text{ ..... ②}$$

Substitute ① into ②.

$$4a + 2(-4a) + 1.4 = 0$$
$$4a - 8a + 1.4 = 0$$
$$4a = 1.4$$
$$a = 0.35$$
$$b = -4(0.35)$$
$$= -1.4$$

(ii)

| $x$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $f(x)$ | 1.4 | 0.35 | 0 | 0.35 | 1.4 |




(b) (i) Brand *P*: Right-skewed data distribution
Brand *Q*: Left-skewed data distribution

(ii) Brand *P*: Interquartile range = 8.3 – 6.2
= 2.1
Brand *Q*: Interquartile range = 9 – 7
= 2

(iii) Rashid should choose the skateboard from brand *Q*. This brand obtains more high ratings from customers than brand *P*. The smaller interquartile range shows the consistency of the product's quality.