1 (a) $\frac{4.32}{32.8 \times 0.593} = 0.2221$

$\approx 2.22 \times 10^{-1}$ (3 s.f.)

(b) $\frac{6.82 \times 10^5}{1.55 \times 10^{-2}} = \left(\frac{6.82}{1.55}\right) \times 10^{5+2} = 4.4 \times 10^7$

Answer (a) 0.222 [1]

(b) 4.4×10^7 [1]

2 (a) Total no. of children $= 6 + 30 + 12$
$= 48$

$\frac{\text{Total no. of children who walked or cycle}}{\text{Total no. of children}} = \frac{30+12}{48} = \frac{7}{8}$

(b) $\frac{6}{48} \times 360^\circ = 45^\circ$

Answer (a) $\frac{7}{8}$ [1]

(b) 45° [1]

3 (a) $\left(\frac{2}{x}\right)^{-3} = \left(\frac{x}{2}\right)^3 = \frac{x^3}{8}$

(b) $2^{3k} \div 2^4 = 2^k$

$2^{3k-4} = 2^k$

$k = 30$

Answer (a) $\frac{x^3}{8}$ [1]

(b) $k =$ 30 [1]

4 (a) 3 hours 41 min $= 3\frac{41}{60}$ hr

(b) Distance travelled
$= 3\frac{41}{60} \times 50$
$= 184.16$
≈ 184 km (nearest km)

Answer (a) $3\frac{41}{60}$ hours [1]

(b) 184 km [1]

5 (a) $\frac{2}{5}$ — \$4.20

$\frac{3}{5}$ — $\frac{\$4.20}{2} \times 3$

$= \$6.30$

(b) \$0.99 — x grams

\$1 — $\frac{100x}{99}$ grams

\$y — $\frac{100xy}{99}$ grams.

Answer (a) \$ 6.30 ..... [1]

(b) $\frac{100xy}{99}$ grams ..... [1]

6 Arc AB $= \frac{1}{4}(2)(\pi)(6)$

$= 3\pi$

Arc OC $= \frac{1}{2}(2)(\pi)(1.5)$

$= 1.5\pi$

Perimeter of the shaded region

$= 3\pi + 1.5\pi + 6 + 3$

$= 4.5\pi + 9$

Answer $(9 + 4.5\pi)$ cm ..... [2]

7 (a) $1.03 \times 10^{10} = 10.3 \times 10^{9}$

$\therefore k = 10.3$

(b) Estimated increase $= 1.03 \times 10^{10} - 6.5 \times 10^{9}$

$= 10^{9}[1.03 \times 10 - 6.5]$

$= 3.8 \times 10^{9}$

Answer (a) $k =$ 10.3 [1]

(b) 3.8×10^{9} [1]

8 (a) when $x = 0$, $2y = 8$

$y = 4$

$\therefore A(0, 4)$

(b) $3x + 2y = 8$

$2y = -3x + 8$

$y = \frac{-3}{2}x + 4$

Answer (a) (0, 4) [1]

(b) $-\frac{3}{2}$ [1]

9 (a) $AC^2 = AB^2 + BC^2$ (Pythagoras' theorem)

$\therefore \angle ABC$ is a right angle.

(b) (i) Area of $\triangle DAC = \frac{1}{2}(5)(8)$

$= 20 \text{ cm}^2$

(ii) $\cos D\hat{A}C = -\cos B\hat{A}C = -\frac{15}{17}$

Answer (a) $AC^2 = AB^2 + BC^2$ (Pythagoras' theorem)

$\therefore \angle ABC$ is a right $\triangle$ [1]

Answer (b)(i) 20 cm^2 [1]

(ii) $\cos D\hat{A}C =$ $-\frac{15}{17}$ [1]

10 (a) $\begin{pmatrix} 14 & 5 & 1 \\ 15 & 0 & 5 \end{pmatrix}\begin{pmatrix} 2 \\ 0 \\ -1 \end{pmatrix}$

$= \begin{pmatrix} 27 \\ 25 \end{pmatrix}$

Answer (a) $\begin{pmatrix} 27 \\ 25 \end{pmatrix}$ [2]

Answer (b) Sandy's score is 27 marks and Roger's score is 25 marks. [1]

11 $\varepsilon = \{2, 3, 4, 5, 6, 7 \ldots\}$

$P = \{2, 3, 5, 7 \ldots\}$

$S = \{4, 9, 16 \ldots\}$

$T = \{2, 12, 22, \ldots\}$

(i) $P \cap T = \{2\}$

$n(P \cap T) = 1$

(ii) $S \cap T = \{\}$

$\therefore n(S \cap T) = 0$

Answer (b)(i) 1 [1]

(ii) 0 [1]

---

12 *Answer (a)* $A = \frac{1}{2}(3x + 5x)(h) + (h+2)(5x)$

$= 4xh + 5xh + 10x$

$= 9xh + 10x$ (shown) [1]

(b) Rearrange the formula to express x in terms of A and h.

$A = 9xh + 10x$

$A = x(9h + 10)$

$x = \frac{A}{9h+10}$

Answer (b) $x = \frac{A}{9h+10}$ [2]

13 $D = ks^2$

when $s = p$, $D = 6$,

$6 = kp^2$

$k = \frac{6}{p^2}$

$\therefore D = \frac{6s^2}{p^2}$

(a) when the speed is increased by 300%

$s = 4p$.

(b) when $s = 4p$,

$D_1 = \frac{6(4p)^2}{p^2}$

$= 96$

(c) Percentage increase

$= \frac{96-6}{6} \times 100\%$

$= 1500\%$

Answer (a) $4p$ m/s [1]

(b) 96 m [1]

(c) 1500 % [1]

14 (i) Median score

= mean of 8th & 9th value

$= \frac{20+21}{2} = 20.5$

Answer (a)(i) 22 [1]

(ii) 20.5 [1]

Interquartile range $= 215 - 120 = 95$

Answer (b) 95 g [1]

15 $2x^3 - 13x^2 + 6x$

$= x(2x^2 - 13x + 6)$

$= x(2x - 1)(x - 6)$

Answer (a) $x(2x-1)(x-6)$ [2]

$9a^2 + 1 - [9a^2 - 6a + 1]$

$= 9a^2 + 1 - 9a^2 + 6a - 1$

$= 6a$

Answer (b) $6a$ [2]

16 (a) $\frac{(n-2)180^\circ}{n} = 165^\circ$

$180n - 360 = 165n$

$180n - 165n = 360$

$15n = 360$

$n = 24$

(b) let x be the remaining interior $\angle$.

$x + 6(125) = (7-2)180$

$x = 150^\circ$

Answer (a) 24 [2]

(b) 150° [2]

17 (a) (i) $1800 = 2^3 \times 3^2 \times 5^2$

(ii) $k = 3 \times 5$

$= 15$

(iii) $42 = 2 \times 3 \times 7$

$HCF = 2 \times 3$

$= 6$

(b) $12 = 2^2 \times 3$

$27 = 3^3$

$90 = 2 \times 3^2 \times 5$

$LCM = 2^2 \times 3^3 \times 5$

$= 540$

540 seconds = 9 min

$2^3 \times 3^2 \times 5^2$

Answer (a)(i) ..... [1]

(ii) $k =$ 15 [1]

(iii) 6 [1]

(b) 9 min 0 sec [2]

18 (a)(i) $2-2x>9$

$-2x>9-2$

$-2x>7$

$x<-3.5$

Answer (a)(i) x <-3.5 [1]

(ii) -4 [1]

(b)

$x-2y=8$

$x=2y+8$ — ①

$3x=19+4y$ — ②

Sub ① into ②,

$3(2y+8)=19+4y$

$6y+24=19+4y$

$2y=-5$

$y=-2.5$

Sub $y=-2.5$ into ①

$x=2(-2.5)+8$

$=3$

Answer (b) $x=$ 3

$y=$ -2.5 [3]

---

19 (a) $\frac{A_1}{A_2}=\left(\frac{h_1}{h_2}\right)^2$

$\frac{h_1}{h_2}=\sqrt{\frac{45}{125}}$

$=\frac{3}{5}$

(b) $\frac{A_1}{A_2}=\frac{45}{125}$

$\frac{63}{A_2}=\frac{45}{125}$

$A_2=175\,cm^2$

(c) $\frac{V_1}{V_2}=\left(\frac{h_1}{h_2}\right)^3$

$\frac{V_1}{2.5}=\left(\frac{3}{5}\right)^3$

$V_1=0.54\,\ell$

$=540\,cm^3$

Answer (a) 3 5 [1]

(b) 175 cm^2 [2]

(c) 540 cm^3 [2]

20 (a) Speed = $20 \div \frac{50}{60} = 24$ km/h

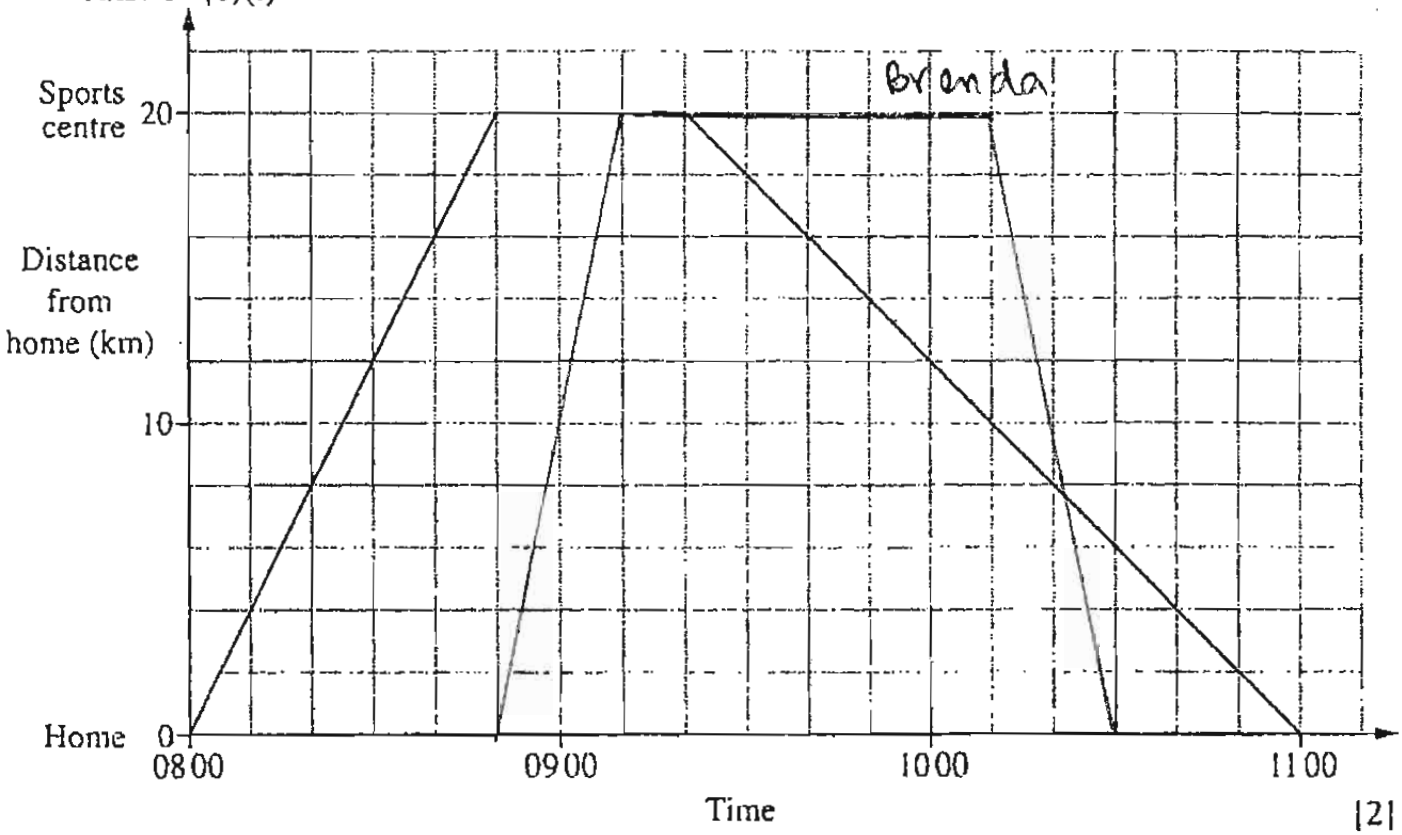
(b) He was 4km from the sport centre.

(c) (ii) Brenda passed Alan at 1022.

Answer (a) 24 km/h [1]

(b) 4 km [1]

Answer (c)(i)



[2]

Answer (c)(ii) 1022 [1]

21

(a) (i) $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$

$= -3\underset{\sim}{a} + 4\underset{\sim}{b}$

(ii) $\overrightarrow{AX} = \frac{3}{4}\overrightarrow{AB}$

$= \frac{3}{4}(-3\underset{\sim}{a} + 4\underset{\sim}{b})$

$= -\frac{9}{4}\underset{\sim}{a} + 3\underset{\sim}{b}$

(iii) $\overrightarrow{OX} = \overrightarrow{OA} + \overrightarrow{AX}$

$= 3\underset{\sim}{a} - \frac{9}{4}\underset{\sim}{a} + 3\underset{\sim}{b}$

$= \frac{3}{4}\underset{\sim}{a} + 3\underset{\sim}{b}$

(iv) $\overrightarrow{XY} = \overrightarrow{XO} + \overrightarrow{OY}$

$= -\frac{3}{4}\underset{\sim}{a} - 3\underset{\sim}{b} + 4\underset{\sim}{b} + \underset{\sim}{a}$

$= \frac{1}{4}\underset{\sim}{a} + \underset{\sim}{b}$

Answer (a)(i) $\overrightarrow{AB} =$ $-3\underset{\sim}{a} + 4\underset{\sim}{b}$ [1]

(ii) $\overrightarrow{AX} =$ $-\frac{9}{4}\underset{\sim}{a} + 3\underset{\sim}{b}$ [1]

(iii) $\overrightarrow{OX} =$ $\frac{3}{4}\underset{\sim}{a} + 3\underset{\sim}{b}$ [1]

(iv) $\overrightarrow{XY} =$ $\frac{1}{4}\underset{\sim}{a} + \underset{\sim}{b}$ [2]

Answer (b) $\overrightarrow{OX} = 3\left(\frac{1}{4}\underset{\sim}{a} + \underset{\sim}{b}\right) = 3\overrightarrow{XY}$

$\therefore$ O, X and Y lie in a straight line. [1]

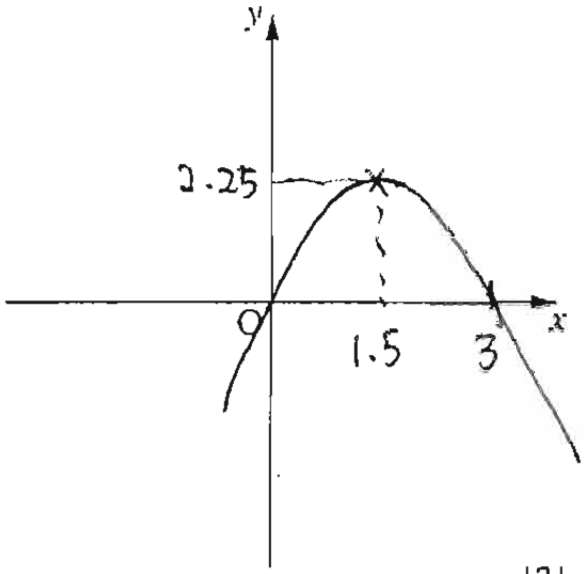
(a)(i) when $y=0$, $x(3-x)=0$

$x=0$ or $3-x=0$

$x=3$

when $x=0$, $y=0$.

Answer (a)(i)



[2]

(ii) $x=1.5$ [1]

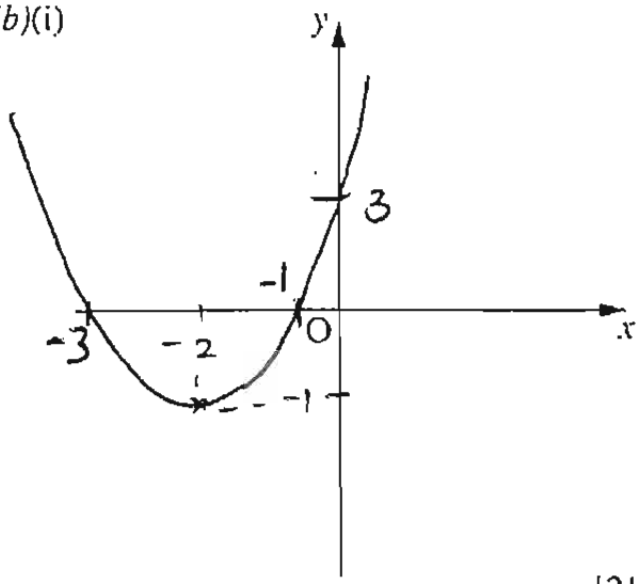
(b)(i) $y=(x+2)^2-1$

min pt $=(-2,-1)$

when $x=0$, $y=2^2-1$

$=3$

Answer (b)(i)



[2]

when $y=0$,

$(x+2)^2-1=0$

$(x+2)^2=1$

$x+2=1$ or $x+2=-1$

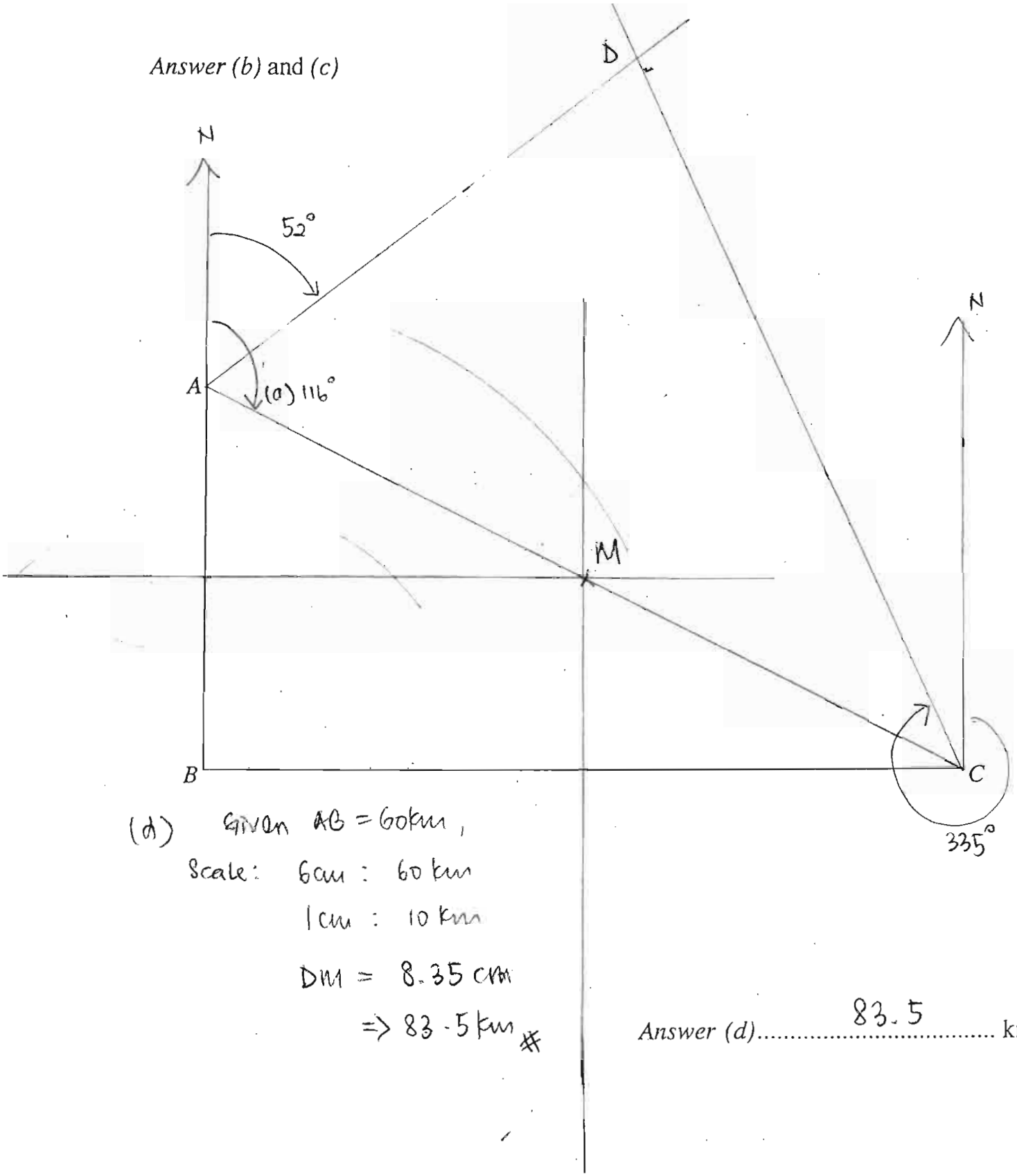
$x=-1$ $\quad x=-3$

(ii) $(-2, -1)$ [1]

23

Answer (a) 116° [1]

Answer (b) and (c)



[4]

(d) Given AB = 60km,

Scale: 6cm : 60 km

1cm : 10 km

DM = 8.35 cm

=> 83.5 km #

Answer (d) 83.5 km [1]