Answer **all** the questions

For Examiner's Use

1 Write the following numbers in order of size, starting with the smallest.

$$0.85,\quad \frac{8}{13},\quad (0.75)^2,\quad \sqrt{0.49}$$

Answer $(0.75)^2$, $\frac{8}{13}$, $\sqrt{0.49}$, 0.85 [1]

---

2 Leo is travelling to Johor Bahru from Singapore. He wants to change 400 Singapore Dollars into Malaysian Ringgit.
In Singapore, the exchange rate is 1 Singapore Dollar = 3.02 Malaysian Ringgit.
In Johor Bahru, the exchange rate is 1 Malaysian Ringgit = 0.328 Singapore Dollars.

Where should he change his money to get more Malaysian Ringgit and by how much more?

S'pore - $400 \times 302 = 1208$ Ringgit
JB - $400 \div 0.328 = 1219.51$ Ringgit

Difference = $1219.51 - 1208 = 11.51$ Ringgit

Answer Johor Bahru, 11.51 Ringgit [2]

---

3 Show that $(5n-1)^2 + 4$ is a multiple of 5.

Answer

$(5n-1)^2 + 4 = 25n^2 - 10n + 5$ [M1]
$= 5(5n^2 - 2n + 1)$ [A1]

[2]

For Examiner's Use

4 Given that $5 \times 5^{2n-2} = 125$, find the value of n.

$5 \times 5^{2n-2} = 5^3$
$5^{1+2n-2} = 5^3$
$1 + 2n - 2 = 3$ [M1]
$2n = 4$
$n = 2$ [A1]

Answer $n =$ _____ [2]

---

5 The first five terms of a sequence are as follows:

78, a, b, 69, c, ...

(a) Find the value of a, b, and c.

$\frac{78 - 69}{3} = 3$

Answer (a) $a =$ 75
$b =$ 72
$c =$ 66 [2]

(b) Write down an expression, in terms of n, for the nth term of the sequence.

Answer (b) $81 - 3n$ [1]

(c) Explain why 32 is not a term of this expression.

Answer (c) ... $81 - 3n = 32$, $n = 16.3$. n is not an integer. .....

Hence 32 is not a term of this expression. ..... [1]

---

6 The angles, in degrees, of a quadrilateral $ABCD$ are represented by these expressions:
Angle $A = (80 - 4x)°$, angle $B = (10 + 3x)°$, angle $C = (5x + 90)°$ and
angle $D = (15x - 10)°$.

(a) Calculate the value of x.

$80 - 4x + 10 + 3x + 5x + 90 + 15x - 10 = 360$
$170 + 19x = 360$
$x = 10$

Answer (a) $x =$ 10 [1]

(b) What is the name of the quadrilateral?

Answer (b) Trapezium [1]

7 Two boxes are geometrically similar. The base area of the smaller box is 64 cm^2 while the base area of the larger box is 81 cm^2.

For Examiner's Use

Calculate the volume of the smaller box as a percentage of the volume of the bigger box.

$$\frac{A_1}{A_2}=\left(\frac{l_1}{l_2}\right)^2=\frac{64}{81}$$

$$\frac{l_1}{l_2}=\frac{8}{9} \qquad [M1]$$

$$\frac{V_1}{V_2}=\left(\frac{l_1}{l_2}\right)^3=\frac{512}{729}$$

$$\frac{V_1}{V_2}\times 100\%=\frac{512}{729}\times 100\%$$

$$=70.2\% \qquad [A1]$$

Answer _____% [2]

8 (a) Express 324 as a product of its prime factors.

Answer (a) $2^2\times 3^4$ [1]

(b) A number has exactly 9 factors. Two of the factors are 4 and 18. List all the factors of the number.

$4=2^2$

$18=2\times 3^2$

Number $=2^2\times 3^2=36$ [M1]

Factors: 1, 2, 3, 4, 6, 9, 12, 18, 36 [A1]

Answer (b) _____ [2]

9 The length of a rectangle exceeds its width by 2 cm.

(a) If the diagonal is 10 cm, find the width of the rectangle.

$x^2+(x+2)^2=10^2$ [M1]

$2x^2+4x-96=0$

$x^2+2x-48=0$

$(x+8)(x-6)=0$

$x=-8(rej)$ *or* 6 [A1]

Answer (a) _____cm [2]

(b) How many squares of side 3 cm can be cut out from this rectangle?

Answer (b) 4 [1]

10 Kenneth invests $2000 for 3 years at a fixed rate of compound interest. At the end of the first year there is $2100 in his account.

[Turn Over]

For Examiner's Use

(a) What is the rate of compound interest?

$$2100=2000\left(1+\frac{r}{100}\right)^1 \qquad [M1]$$

$$r=\left(\frac{2100}{2000}-1\right)\times 100=5 \qquad [A1]$$

Answer (a) _____% [2]

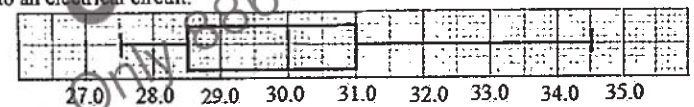
(b) How much does Kenneth have in his account at the end of 3 years?

Sum at the end of 3 years $=2000\left(1+\frac{5}{100}\right)^3$ [M1]

$=2315.25$ [A1]

Answer (b) $ _____ [2]

11 The diagram shows the box-and-whisker plot for the power, in kilowatts(kW), supplied to an electrical circuit.



(a) Find the median of the power supplied.

Answer (a) 30.0 kW [1]

(b) Find the interquartile range.

Answer (b) 2.5 kW [1]

12 A is the point $(-1, 4)$, B is the point $(2, -5)$ and O is the origin.

(a) Find the gradient of the line OA.

$$\frac{4-0}{-1-0}=-4$$

Answer (a) −4 [1]

(b) Find the equation of the line through B parallel to OA.

$y=-4x+c$ [M1]

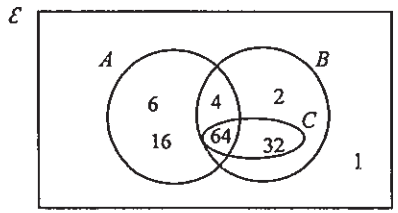
Sub (2, −5) into eqn

$c=3$

Answer (b) $y=-4x+3$ [A1] [2]

13 The Venn Diagram represents the sets A and B.

For Examiner's Use



(a) List the elements of $(A \cup B)'$.

Answer (b) ____{1}_____ [1]

(b) Find $n(A' \cap B)$.

Answer (b) _____2_____ [1]

(c) Set C is defined as the first two multiples of 32. Insert set C in the Venn diagram above. [1]

14 Simplify

(a) $27x^3y^{-2} \div 18xy^3$

$\frac{27x^3y^{-2}}{18xy^3} = \frac{3}{2}x^{3-1}y^{-2-3}$

$= \frac{3}{2}x^2y^{-5}$ [A1]

Answer (a) _____ [1]

(b) $\frac{2}{(x-3)^2} - \frac{1}{3-x}$

$= \frac{2}{(x-3)^2} + \frac{1}{x-3}$ [M1]

$= \frac{2+(x-3)}{(x-3)^2}$ [M1]

$= \frac{x-1}{(x-3)^2}$ [A1]

Answer (b) _____ [3]

15 A bicycle accelerates from rest at a constant rate to a certain speed in 10 seconds. It maintains at this speed for the next 10 seconds. The total distance travelled by the bicycle in the 20 seconds is 240 metres.

For Examiner's Use

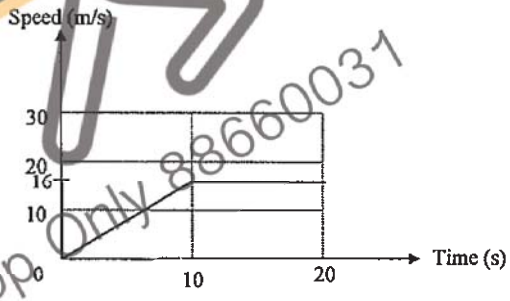
(a) Calculate the speed of the bicycle in the tenth second and

$\frac{1}{2}(x)(10) + (x)(10) = 240$ [M1]

$x = 16$ [A1]

Answer (a) _____m/s [2]

(b) draw the speed-time graph of the car's journey for the first 20 seconds,



[2]

16 Factorise

(a) $4x^2 - 10x - 6$,

$= 2(2x^2 - 5x - 3)$ [M1]

$= 2(2x+1)(x-3)$ [A1]

Answer (a) _____ [2]

(b) $10x^2y - 5xy + 2x - 1$.

$= 5xy(2x-1) + 1(2x-1)$ [M1]

$= (5xy+1)(2x-1)$ [A1]

Answer (b) _____ [2]

17 A two digit number is formed using the digits 4, 8 and 9. Repetition of the digit is allowed.

(a) List the sample space.

Answer (a) {44, 48, 49, 84, 88, 89, 94, 98, 99} [1]

(b) Find the probability that a number selected at random is

(i) a prime number,

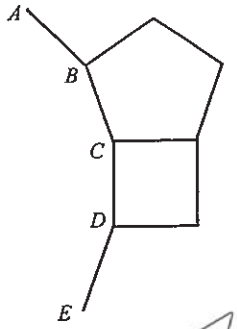
Answer (b)(i) $\frac{1}{9}$ [1]

(ii) divisible by 5.

Answer (b)(ii) 0 [1]

For Examiner's Use

18



The diagram below is made up of a square, a regular pentagon and an incomplete regular polygon *ABCDE* of *n* sides. Find the value of *n*.

Int. angle of pentagon $= \frac{(5-2)\times 180°}{5} = 108°$ [M1]

Int. angle of polygon $= 360° - 108° - 90° = 162°$ [M1]

Ext. angle of polygon $= 180° - 162° = 18°$ [M1]

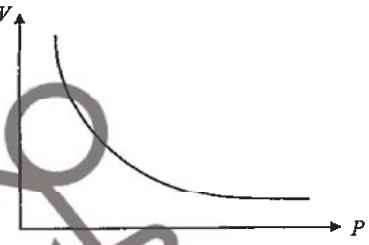
$n = \frac{360°}{18°} = 20$ [A1]

Answer $n =$ [4]

19 The volume, V, of a given mass of gas, is inversely proportional to the pressure, P.

(a) Sketch a volume-pressure graph for the mass of gas.

Answer (a)



[1]

When the volume is 3 m^2, the pressure of the gas is 200 N/m^2.

(b) Find the equation for V in terms of P.

$V = \frac{k}{P}$ [M1]

$3 = \frac{k}{200}, k = 600$

$V = \frac{600}{P}$ [A1]

Answer (b) $V =$ [2]

(c) Calculate the pressure when the volume is 5 m^2.

$5 = \frac{600}{P}$

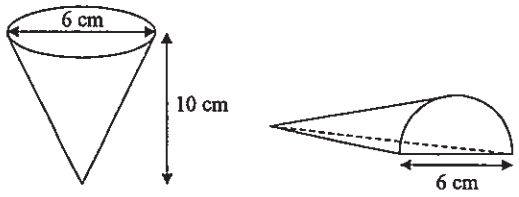
$P = \frac{600}{5}$

$= 120$ [A1]

Answer (c) N/m^2 [1]

For Examiner's Use

20



A rubber cone of diameter 6 cm and height 10 cm is cut in half to make two rubber door stoppers. Find

(a) the volume of a rubber stopper,

$$V = \frac{1}{2}\left[\frac{1}{3}\pi(3)^2(10)\right]$$
$$= 47.1 \qquad [A1]$$

Answer (a) _____ cm^3 [1]

(b) the total surface area of a rubber stopper.

Slant height $= \sqrt{10^2 + 3^2} = \sqrt{109}cm$ [M1]

$$A = \frac{1}{2}\times\left[\pi(3)^2\right] + \frac{1}{2}\times 6\times 10 + \frac{1}{2}\times\pi\times 3\times\sqrt{109} \quad [M1]$$
$$= 93.3 \qquad [A1]$$

Answer (b) _____ cm^2 [3]

For Examiner's Use

21 The following shows the Formula 1 track where the turns along the track are numbered 01 to 23.

(a) Estimate the actual length of the track from turn 04 to turn 07.

Answer (a) _1200 t0 1400___ m [1]

(b) A racer finished the 309.316 km race in 1 h 45.599 min. Calculate the average speed in km/h.

1 h 45.599 min = 1.759983 h

$$\text{Av. Speed} = \frac{309.316}{1.759983} = 176 \qquad [A1]$$

Answer (b) _____km/h [1]

(c) Suggest and explain a possible speed when the racer
(i) went past the grandstand,

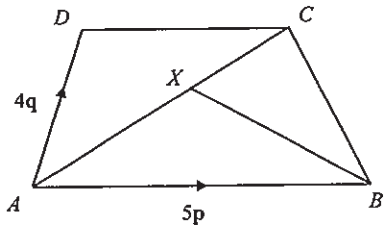
Answer (i) When the racer passed the grandstand, the speed should be higher than the average speed as the course is relatively straight. Speed should be around 200 km/h..... [1]

(ii) was at turn 05.

Answer (ii) The racer should slow down at turn 05 and the speed is lower than the average speed. Speed should be around 150 km/h. ..... [1]

For Examiner's Use

22



$ABCD$ is a quadrilateral.
$\overrightarrow{AB} = 5\,\mathbf{p}$, $\overrightarrow{AD} = 4\,\mathbf{q}$, $DC : AB = 3 : 5$, $AX : AC = 5 : 8$.
(a) Write each of the following in terms of **p** and **q**.

(i) $\overrightarrow{AC}$,

$$\overrightarrow{AC} = \overrightarrow{AD} + \overrightarrow{DC}$$
$$= 4q + \frac{3}{5}\overrightarrow{AB}$$
$$= 4q + \frac{3}{5}(5p)$$
$$= 4q + 3p \qquad [A1]$$

Answer (a)(i) _____ [1]

(ii) $\overrightarrow{BX}$

$$\overrightarrow{BX} = \overrightarrow{AX} - \overrightarrow{AB}$$
$$= \frac{5}{8}\overrightarrow{AC} - 5p$$
$$= \frac{5}{8}(4q + 3p) - 5p$$
$$= \frac{5}{2}q - \frac{25}{8}p \qquad [A1]$$

Answer (a)(ii) _____ [1]

(iii) $\overrightarrow{XD}$

$$\overrightarrow{XD} = \overrightarrow{AD} - \overrightarrow{AX}$$
$$= 4q - \frac{5}{8}\overrightarrow{AC}$$
$$= 4q - \frac{5}{8}(4q + 3p)$$
$$= \frac{3}{2}q - \frac{15}{8}p \qquad [A1]$$

Answer (a)(iii) _____ [1]

(iv) Explain why B, X and D lie in a straight line.

Answer ... $\overrightarrow{BX} = \frac{5}{8}(4q - 5p)$ *and* $\overrightarrow{XD} = \frac{3}{8}(4q - 5p)$, hence $BX = \frac{5}{3}XD$

... B, X and D lies in a straight line..... [1]

[Turn Over

23 A particular restaurant offers 3 different dinner set menu Deluxe, Superior and Economy Set Package. The following table shows the orders for the three set packages on three days of a particular week.

	Deluxe	Superior	Economy
Friday	35	45	60
Saturday	70	85	150
Sunday	90	130	180

(a) Represent the number of orders for each type of set package on the three days by a 3×3 matrix A.

$$\begin{pmatrix} 35 & 45 & 60 \\ 70 & 85 & 150 \\ 90 & 130 & 180 \end{pmatrix}$$

Answer (a) $A =$ _____ [1]

(b) Given that each Deluxe, Superior and Economy Set Package costs \$188, \$88 and \$38 respectively, write down a 3×1 matrix B showing the price for each type of the set packages.

$$\begin{pmatrix} 188 \\ 88 \\ 38 \end{pmatrix}$$

Answer (b) $B =$ _____ [1]

(c) Evaluate the matrix $C = AB$.

$$C = \begin{pmatrix} 35 & 45 & 60 \\ 70 & 85 & 150 \\ 90 & 130 & 180 \end{pmatrix}\begin{pmatrix} 188 \\ 88 \\ 38 \end{pmatrix}$$

$$= \begin{pmatrix} 12820 \\ 33840 \\ 35200 \end{pmatrix} \qquad [A1]$$

Answer (c) $C =$ _____ [1]

(d) State what the elements of C represents.

Answer (d) ...It represents the restaurant takings from the three set packages on each day. ..... [1]

(e) For Mothers' Day, the restaurant give a discount of 20% for Deluxe Set, 15% for Superior Set and 10% for Economy Set.
Matrix N is a 3 x 1 matrix that represents the price for each type of the set packages after the respective discount.
$M = (20 \quad 30 \quad 45)$ represents the order for these set Packages on Mothers' Day.
Evaluate $Q = MN$ and state what the element of Q represnt.

$$N = \begin{pmatrix} 150.4 \\ 74.8 \\ 34.2 \end{pmatrix} \qquad [M1]$$

$$Q = (20 \quad 30 \quad 45)\begin{pmatrix} 150.4 \\ 74.8 \\ 34.2 \end{pmatrix}$$

$$= (6791) \qquad [A1]$$

Answer (e) $Q =$ _____ [2]

Answer (e) ...The restaurant total takings from the three set packages on

...Mothers' day..... [1]

24 Density, d kg/m^3, of a material is the mass, m kg, per unit volume, v m^3, in which

$$d = \frac{m}{v}.$$

An alloy is a mixture of metals.

If 0.0002 m^3 of copper is mixed with 0.0008 m^3 of tin, 7.62 kg of the alloy is formed.

If 0.0005 m^3 of copper is mixed with 0.0005 m^3 of tin, 8.1 kg of the alloy is formed.

Calculate the density of each of the two metals.

$7.62 = d_c \times 0.0002 + d_t \times 0.0008$

$38100 = d_c + 4d_t$ ----------(1) [M1]

$8.1 = d_c \times 0.0005 + d_t \times 0.0005$

$16200 = d_c + d_t$ ----------(2) [M1]

(1) – (2) [M1]

$3d_t = 21900$

$d_t = 7300$ [A1]

Sub $d_t = 7300$ *into* (2)

$d_c = 8900$ [A1]

Answer d_{copper} = _____ kg/m^3, d_{tin} = _____ kg/m^3 [5]

~ End of Paper ~

Marking Scheme

Sec 4E5N/4N1-Maths P2-Prelim-2019

1 (a) (i)	$V=\frac{1}{3}(2)^2(3)+(-1)(5)$ $=-1$
1 (a) (ii)	$V=\frac{1}{3}ax^2+by$ $V-by=\frac{1}{3}ax^2$ $3(V-by)=ax^2$ $\frac{3(V-by)}{a}=x^2$ $x=\pm\sqrt{\frac{3(V-by)}{a}}$
1 (b)	$\frac{6ab+15b}{4a^2-25}=\frac{3b(2a+5)}{(2a+5)(2a-5)}$ $=\frac{3b}{2a-5}$
1 (c)	$2=\frac{3}{x+1}+\frac{1}{x(x+1)}$ $2=\frac{3x}{x(x+1)}+\frac{1}{x(x+1)}$ $2=\frac{3x+1}{x^2+x}$ $2x^2+2x=3x+1$ $2x^2-x-1=0$ $(2x+1)(x-1)=0$ $x=-0.5$ or $x=1$
1 (d)	$\frac{x}{3}+\frac{5}{6}<\frac{5x}{3}$ $\frac{2x+5}{6}<\frac{10x}{6}$ $2x+5<10x$ $5<8x$ $8x>5$ $x>\frac{5}{8}$

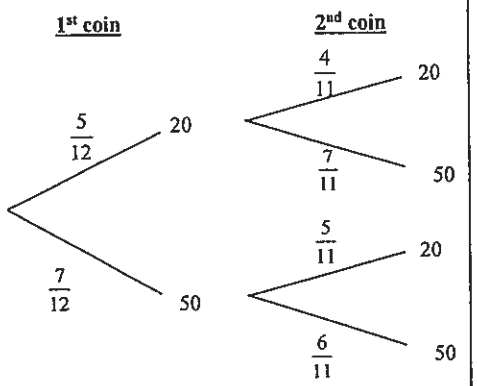
	smallest prime number = 2
2 (a)	3210
2 (b)	$\frac{3.11\times10^9}{365}=8520547.945$ $=8.52\times10^6$ (3 s.f.)
2 (c)	$\frac{3.21\times10^9}{3.21\times10^9+2.98\times10^9+3.11\times10^9}\times100$ $=34.5\%$ (3 s.f.)
2 (d)	$\frac{3.65\times10^9-3.11\times10^9}{3.65\times10^9}\times100$ $=14.8\%$ (3 s.f.)
2 (e)	$\frac{125}{100}\times3.11\times10^9$ = 4 billions (nearest billion) or 4 000 000 000 (nearest billion) or 4×10^9 (nearest billion)
3	Refer to graph paper

4 (a)	Triangle DXY
4 (b)	$\angle ACW = \angle ZCY$ (vert. opp. angles) $\angle WAC = \angle YZC$ ($WA // ZY$, alt. angles) By AA similarity, triangle WAC is similar to triangle YZC.
4 (c) (i)	$\frac{\text{area of triangle } DBC}{\text{area of triangle } DXY} = \left(\frac{8}{24}\right)^2$ $= \frac{1}{9}$ Area of triangle $DXY = 48 \times 9$ $= 432 \text{ cm}^2$
4 (c) (ii)	By similarity, $\frac{WA}{YZ} = \frac{AC}{ZC}$ $\frac{WA}{12} = \frac{14}{10}$ $WA = \frac{14}{10} \times 12$ $= 16.8$ $\frac{WX}{ZY} = \frac{16.8+12}{12}$ $= \frac{12}{5}$ $WX : ZY = 12 : 5$
4 (c) (iii)	$\frac{\text{area of } ACXY}{\text{area of triangle } CZY} = \frac{\frac{1}{2}(6+8+24)(\text{ht})}{\frac{1}{2}(10)(\text{ht})}$ $= \frac{19}{5}$
5(a)(i)	$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$ $= \begin{pmatrix} 3 \\ -8 \end{pmatrix}$
(ii)	$\sqrt{3^2+8^2}$ $= 8.54$ units (3 s.f.)

(iii)	$\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$ $= \begin{pmatrix} -1 \\ 5 \end{pmatrix} + 3\overrightarrow{AB}$ $= \begin{pmatrix} -1 \\ 5 \end{pmatrix} + 3\begin{pmatrix} 3 \\ -8 \end{pmatrix}$ $= \begin{pmatrix} 8 \\ -19 \end{pmatrix}$ C (8, -19)
(b)(i)	Gradient of $PQ = \frac{12}{-8} = -\frac{3}{2}$ $y = -\frac{3}{2}x + c$ $-2 = -\frac{3}{2}(4) + c$ $c = 4$ $y = -\frac{3}{2}x + 4$
(ii)	$3x + 2y = 11$ $y = -\frac{3}{2}x + 5.5$ Both lines have the same gradient so they are parallel and will not intersect
6(a)(i)	Reflex $AOC = 4.6$ rad (angle at centre = 2X angle at circum) Angle $AOC = 2\pi - 4.6 = 1.684$ $AO = \frac{5}{\sin 0.842}$ $= 6.703$ m (shown)
(ii)	Arc ABC $= 6.703 \times 1.684$ $= 11.3$ m
(b)	Cross sectional area = $\frac{1}{2} \times (6.703)^2 \times 1.684 - \frac{1}{2}(6.703)^2 \sin 1.684$ $= 15.5099$ $= 15.5 \text{ m}^2$

	Volume $= 15.5099 \times 100$ $= 1551\ m^3$ The rain will overflow from the drain as the rain flowing is more than the capacity of the drain
7(a)(i)	34° (ext angle of triangle / angle at centre = 2 X angle at circum)
(ii)	56° (angle sum of isos triangle)
(iii)	$= \frac{180+68}{2}$ $= 124°$ (angle at centre = 2 X angle at circum)
(iv)	$= 180-34-124$ $= 22°$ (int angle, OA parallel to BC)
(b)	Both triangles have common height $= \frac{1}{3}(30)$ $= 10\ cm^2$
(c)	Area of semicircle $= 30 + 36.375 = 66.375$ $\frac{1}{2}\pi r^2 = 66.375$ $r = 6.50$ cm
8(a)	$\frac{1500}{x}$
(b)	$\frac{1500}{x+3}$
(c)	$\frac{1500}{x} - \frac{1500}{x+3} = 28$ $4500 = 28x(x+3)$ $28x^2 + 84x - 4500 = 0$ $7x^2 + 21x - 1125 = 0$ (shown)

(d)	$x = \frac{-21 \pm \sqrt{21^2 - 4(-1125)(7)}}{2(7)}$ $= 11.266$ *or* -14.266
(e)	$t = \frac{1500}{11.266}$ $= 133$ mins $= 2$ h 13 mins
9(a)(i)	$BC^2 = 68^2 + 45^2 - 2(68)(45)\cos 118$ $BC = 97.582$ $= 97.6m$ (3 s.f.)
(ii)	$= \frac{1}{2}(68)(45)\sin 118$ $= 1350m^2$ (3 s.f.)
(b)	$\frac{1}{2}(97.582)h = 1350.9$ $h = 27.7m$ (3 s.f.)
(c)(i)	$h = 45\tan 16$ $= 12.9m$ (3 s.f.)
(ii)	$\tan\theta = \frac{12.904}{27.688}$ $\theta = 25.0°$ (1 d.p.)
10(a)(i)	$= \frac{45\times13 + 55\times16 + 65\times8 + 75\times3}{40}$ $= 55.25$ kg
(ii)	$\sqrt{\frac{125400}{40} - 55.25^2}$ $= 9.08$ kg (3 s.f.)
(b)	Class 4B is heavier than 4A as the mean is higher. Class 4A weight is more consistent as the S.D. is smaller.
(c)(i)	

	
ii(a)	$\frac{5}{12}\times\frac{4}{11}$ $=\frac{5}{33}$
(b)	$\frac{5}{12}\times\frac{7}{11}+\frac{5}{11}\times\frac{7}{12}$ $=\frac{35}{66}$