June 98
Paper 2

1- \( 52 - 3 (4.1 - 1.8) = 52 - 3 (2.3) = 45.1 \)  
   Answer: 45.1

2- (a) \( 3 \text{ cm/min} = \frac{3}{100 \times 1000} \times 60 = 0.0018 \)  
   Answer: 0.0018 Km/h

   (b) \( 0.0018 = 1.8 \times 10^{-3} \text{ km/h} \)  
   Answer: 1.8\times10^{-3} \text{ km/h}

3- (a) \( \angle ABT = \frac{1}{2} \angle AOT = \frac{1}{2} \times 64 = 32^\circ \)  
   Answer: Angle ABT = 32°

   (b) AB perpendicular to OT  
   \( \angle OTB = 90 - \angle ABT = 90 - 32 = 58^\circ \)  
   Answer: Angle OTB = 58°

4- \( I = \frac{PRT}{100} \)  
   \( 50 = \frac{250 \times R \times 5}{100} \)  
   \( 5000 = 1250R \)  
   \( R = 4 \)  
   Answer: R = 4

5- (a)
(b) $\overrightarrow{AD} = \overrightarrow{BC} = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$

Answer: $\overrightarrow{AD} = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$

6- \[ \frac{a}{6} + \frac{b}{21} = \frac{17}{42} \]

7a + 2b = 17

now we can select any positive integer for a and then find b

try \ a = 1 \n
7 \times 1 + 2b = 17

2b = 10 \quad b = 5

as b obtained is positive integer, it is correct

Answer: a = 1 \quad b = 5

7- 2 min 23 sec = $2\frac{23}{60}$ = 2.383

(or use calculator $2\frac{23}{60}$ = 2.383).

2.3 \quad is \quad 2.3

$2\frac{1}{3} = 2.333$

2.23 = 2.23 \quad Answer: 2.23 < 2.3 < 2\frac{1}{3} < 2 \text{ min 23 sec}

8- 3x - y = 4 \quad (1)

x - y = 8 \quad (2)

-x + y = -8 \quad (2) \times -1

3x - y = 4 \quad (1)

\[ \begin{array}{c}
2x = -4 \\
x = -2
\end{array} \]

substitute to get y

3 (-2) - y = 4

-6 - y = 4

-y = 10 \quad y = -10

Answer: x = -2, y = -10

9- (a) Look at the graph, Locate where the gradient of the graph is Largest.

It is in the part of the graph after 18 sec

You will find that the gradient is largest at t = 19

(b) Total distance travelled = 2 d

Average speed = $\frac{Total distance}{Total time}$

1.5 = $\frac{2d}{24}$

2d = 24 x 1.5 = 36 \quad d = 18 m
10- (a) \( \angle OAM = 180 - 83 = 97^\circ \)
\( \angle AOM = 180 - (97 + 58) = 25^\circ \)

OR \( \angle AOM = 83 - 58 = 25^\circ \)

(b) Given \( AM : MB = 1 : 2 \)

\( AM : AB = 1 : 3 \)

Area of parallelogram = \( 96 \text{ cm}^2 \)

Area of \( \Delta AOB = \frac{1}{2} \times 96 = 48 \text{cm}^2 \)

\( \Delta \)'s AOM and AOB have the same height but different base

base \( AM = \frac{1}{3} \) base \( AB \)

Area of \( \Delta AOM = \frac{1}{3} \) area of \( \Delta AOB \)

\[ = \frac{1}{3} \times 48 = 16 \text{cm}^2 \]

Answer: \( 16 \text{cm}^2 \)

11- \( \sin x = -0.866 \quad \cos x = -0.5 \quad 0 \leq x \leq 360^\circ \)

The quadrant in which sine and cosine are both negative is the 3\text{rd}. Quad

Using calculator the angle whose sine = 0.866 (or its cosine 0.5) is \( 60^\circ \)

\[ \therefore x = 180 + 60 = 240^\circ \]

Answer: \( x = 240^\circ \)

12- (a) \( 3x - 2 < 15 \)

\[ 3x < 17 \quad x < \frac{17}{3} \quad x < \frac{52}{3} \]

\[ \therefore A = \{ 1, 2, 3, 4, 5 \} \]

n(\( A \)) = 5

Answer: n(\( A \)) = 5

(b) \( 4x + 1 \geq 13 \quad 4x \geq 12 \quad x \geq 3 \)

\[ B = \{ 3, 4, 5, \ldots \ldots \ldots \text{ etc } \} \]

Answer: \( A \cap B = \{ 3, 4, 5 \} \)

13- (a) \( \frac{360}{20} = 18 \quad 180 - 18 = 162^\circ \)

Answer: Angle ABC = 162\(^\circ \)

(b) \( \angle ACB = \frac{180 - 162}{2} = 9^\circ \)

Answer: Angle ACB = 9\(^\circ \)
14- (a) \[ 50 - \frac{5}{2} \leq \text{mass} < 50 + \frac{5}{2} \]

(i) \[ 47.5 \text{ g} \leq \text{mass} < 52.5 \text{ g} \]
(ii) \[ 8.5 \text{ cm}^3 \leq \text{volume} < 9.5 \text{ cm}^3 \]

(b) Least possible density = \[ \frac{\text{Least mass}}{\text{Largest volume}} \]

\[ = \frac{47.5}{9.5} = 5 \]

Answer: \( 5 \text{ g/cm}^3 \)

15- (a) \[ \sqrt[6]{x^{36}} = (x^{36})^{\frac{1}{6}} = x^{18} \]

(b) \[ 10^q = 1 \]

\[ q = 0 \]

(c) \[ r^{-2} = \frac{1}{4} \]

\[ r = \left( \frac{1}{4} \right)^{-2} = \left( \frac{4}{1} \right)^2 = 16 \]

Answer: 16

16- (a) Answer Angle OBC = 90 - 50 = 40°

(b) (i) \( \angle OAB = 50° \)

Bearing of B from A is 180 - 50 = 130°

(ii) \( \angle OCB = \angle OBC = 40° \)

Bearing of B from C is 040°

Bearing of C from B is 180 + 40 = 220°

Answer: 130°, 220°

17- \[ \frac{T}{W + 3} = V \]

\[ (W + 3) V = T \]

\[ W + 3 = \frac{T}{V} \]

\[ W = \frac{T}{V} - 3 \]

Answer: \( W = \frac{T}{V} - 3 \)

18- (a) Number of boys = \( \frac{5}{12} \times 480 = 200 \)

Number of girls = 480 - 200 = 280

Answer: 280

(b) Number of students aged 15 or over = \( \frac{3}{10} \times 480 = 144 \)

Number of students aged under 15 = 480 - 144 = 336

Answer: 336
(c) Number of girls under 15 = $\frac{7}{16} \times 480 = 210$

Number of girls 15 or above = $280 - 210 = 70$

Number of boys aged 15 or over = $144 - 70 = 74$

<table>
<thead>
<tr>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>15 or over 15, Total 144</td>
</tr>
<tr>
<td>210</td>
<td>Under 15, Total 336</td>
</tr>
<tr>
<td>200</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td>Total</td>
</tr>
</tbody>
</table>

19- (a) $g(5) = f(2 \times 5 + 1) = f(11) = 11^2 = 121$

(b) $y = 2x + 1$

$2x = y - 1$

$x = \frac{y - 1}{2}$

$g^{-1}(x) = \frac{x - 1}{2}$

Answer: $g^{-1}(x) = \frac{x - 1}{2}$

20- Answer: $x \geq 1$

$y \leq 5$

$y \leq x + 2$

21- (a) (i) Ratio of areas is $K^2$

$K^2 = 36$

$K = 6$

Answer: $6:1$

(ii) Length = $6 \times 0.7 = 4.2$ m

(b) Ratio of volumes = $K^3 = 6^3 = 216$

Answer: $4.2$ m

22- (a) $\sin \angle AOC = \frac{12}{13}$

$\angle AOC = 67.4^\circ$
(b) (i) Area of sector = \( \frac{\theta}{360} \times \pi \times R^2 \)
\[ = \frac{67.4}{360} \times \pi \times 13^2 = 99.4 \text{ cm}^2 \]
Answer: 99.4 cm²

(ii) shaded area = area of sector – area of triangle
Third side of the triangle = \( \sqrt{13^2 - 12^2} = 5 \)
area of triangle = \( \frac{1}{2} \times 12 \times 5 = 30 \)
Shaded area = 99.4 – 30
\[ = 69.4 \text{ cm}^2 \]
Answer: 69.4 cm²

23- (a) Pyramid
(b) By measurement
Length of one side of the square base = 6 cm
Height of each of the triangular faces is = 5.2 cm
Total surface area = \( 6 \times 6 + 4 \times \frac{1}{2} \times 6 \times 5.2 \)
\[ = 98.4 \text{ cm}^2 \]
Answer: 98.4 cm²

(c) VM is the height of one of the triangular faces = 5.2
\[ h \text{ is the height of pyramid} \]
height \( h = \sqrt{5.2^2 - 3^2} \)
\[ = 4.25 \text{ cm} \]

24- (a) (i) \( x(x - 1)(x + 1) = 40(x + x - 1 + x + 1) \)
\[ x(x - 1)(x + 1) = 40(3x) \]
(ii) \( x(x^2 - 1) = 120x \)
\[ x^3 - x = 120x \]
\[ x^3 - 121x = 0 \]
(b) \( x^3 - 121x = x(x^2 - 121) = x(x + 11)(x - 11) \)
(c) \( x(x + 11)(x - 11) = 0 \)
\[ x = 0, -11, 11 \]
Possible answer is 11
Three positive integers are 10, 11, 12
1- Using calculator Angle $A = 22.5^\circ$

2- Sugar fruit
   3 $2 \frac{1}{2}$
   ? $4$
   Quantity of sugar $= \frac{4 \times 3}{2 \frac{1}{2}} = 4.8 \text{ kg}$

3- 

4- $x - 4, x, 2x, 2x + 12$
   Median is the average of $x$ and $2x$,
   the two middle numbers, therefore $\frac{x + 2x}{2} = 9$
   $3x = 18$
   $x = 6$

5- (a) $\frac{20}{2} = 10$
   $220 - 10 \leq r < 220 + 10$
   $210 \leq r < 230$
   (b) Circumference $= 2\pi r = 2 \times 3.142 \times 210$
   $= 1319.64 \approx 1320 \text{ cm}$

6- (a) Trapezium.
7- Time difference between 2034 and 1634 is 4 hours
The new train journey time is \(80\% = \frac{80}{100} \times 4 = 3.2\) hours
Using calculator 16 $\frac{19}{34} 34 \text{ shift } 1946$

8- (a) \(2x^2 - 5x - 3 = (2x + 1)(x - 3)\)
(b) \(2x^2 - 5x - 3 = 0\)
\((2x + 1)(x - 3) = 0\)
\(x = -\frac{1}{2}\) or \(x = 3\)

9-(a)

(b) Acceleration \(= \frac{20}{15} = \frac{4}{3}\) m/s\(^2\)

(c) Distance \(= \text{area under the graph.}\)
\(= \frac{1}{2} \times 15 \times 20 = 150\) m

10- \(\frac{x + 3}{2} - \frac{x - 4}{5} = \frac{5(x + 3) - 2(x - 4)}{10} = \frac{5x + 15 - 2x + 8}{10} = \frac{3x + 23}{10}\)
11- (a) (i) \( x = 4 \cos (180t)^\circ \)
\[ t = 0.4 \quad x = 4 \cos (180 \times 0.4) \]
\[ = 4 \cos 72^\circ = 1.236 \approx 1.24 \]
(ii) \( x = 4 \cos (180 \times 1.3) \)
\[ = 4 \cos 234^\circ = -2.351 \]
(b) negative \( x \) means to the left of the vertical line (or on the other side).

12-

13- (a) Answer: C
(b)

14- (a) (i) \( \frac{L}{100} = (0.9)^{5.4} = (0.9)^{3.1.4} = (0.9)^7 \)
\[ L = 100 \times 0.4783 = 47.83 \% \]
(ii) \( \frac{L}{100} = (0.9)^{5.2.7} = (0.9)^{13.5} = 0.2411 \)
\[ L = 24.1\% \]
(b) \[ \frac{81}{100} = (0.9)^5 \] \[ 0.81 = (0.9)^2 \]
\[ \therefore 5d = 2 \] \[ d = \frac{2}{5} = 0.4 \]

15- \[ \angle x = 180 - (135 + 27) = 180 - 162 = 18^\circ \]
\[ \frac{12}{\sin 135} = \frac{YZ}{\sin 18^\circ} \]
\[ YZ = \frac{12 \sin 18^\circ}{\sin 135^\circ} = 5.24 \text{ cm} \]

16- (a) gradient \[ m = \frac{8 - 2}{8 - 0} = \frac{6}{8} = \frac{3}{4} \] 
\[ y \text{ intercept } c \text{ is } 2 \]
(b) \[ AB = \sqrt{(8 - 0)^2 + (8 - 2)^2} = \sqrt{64 + 36} = \sqrt{100} = 10 \]

17- (a) Cost for 5 days = 5 \times 23 = 115
Free kilometres = 5 \times 40 = 200 \text{ Km}
Extra distance charge = (350 - 200) \times 0.25 = 37.5
Total cost = 115 + 37.5 = 152.5 \$
(b) Cost for \ p \text{ days} = 23 \ p
Extra distance charge = (q - 40 \ p) \times 0.25 = \frac{1}{4} q - 10 \ p
Total cost = 23 \ p + \frac{1}{4} q - 10 \ p = 13 \ p + \frac{1}{4} q \ \$

18-

(a) \[ \tan \alpha = \frac{2}{2.5} \] \[ \alpha = 38.66^\circ \]
Angle \ x = 180 - 2x = 102.68 = 102.7^\circ 
(b) Angle of view now is angle PBQ = angle APB
\[ \tan \theta = \frac{5}{2} = 2.5 \] \[ \text{Angle} = 68.2 \]

19-(a) \[ h \propto v^2 \]
\[ v = 4 \]
\[ \therefore h = kv^2 \]
\[ h = 80 \]
\[ 0.80 = k4^2 = 16k \]
\[ k = \frac{80}{16} = 5 \]
\[ \therefore h = 5v^2 \]

(b) (i) \( h = 5v^2 = 5(6)^2 = 180 \text{ cm} \)

(ii) \( h = 20 \text{ m} = 20 \times 100 = 2000 \text{ cm} \)
\[ 2000 = 5v^2 \]
\[ v = \frac{2000}{5} = 400 \text{ m/s} \]

20- (a) Each Exterior angle = \( \frac{360}{9} = 40^\circ \)

Each Interior angle = \( 180 - 40 = 140^\circ \)

(b) (i)

(ii) Angle DCG = 60^\circ

(iii) The shape CDEFG is a 5 sided polygon (pentagon)
The sum of all its interior angles = \( (2n - 4) \times 90 = (2 \times 5 - 4) \times 90 = 540^\circ \)
Three of its angles are each 140
\[ 140 \times 3 = 420 \]
(Sum of the other two angles) = 540 - 420 = 120^\circ

Value of each angle = \( \frac{120}{2} = 60 \)