1(a) \[
\frac{3}{4a^2 - 25} - \frac{2}{5 - 2a} = \frac{3}{(2a - 5)(2a + 5)} - \frac{2}{5 - 2a} = \frac{3(2a - 5)}{(2a - 5)(2a + 5)} + \frac{2}{2a - 5} = \frac{3 + 2(2a + 5)}{(2a - 5)(2a + 5)} = \frac{4a + 13}{(2a - 5)(2a + 5)}
\]

1(b) We have \( p \propto \frac{1}{q^2} \Rightarrow p = \frac{k}{q^2} \), where \( k \) is a constant.

When the value of \( q \) is tripled, new \( q = 3q \).

New \( p = \frac{k}{(3q)^2} = \frac{pq^2}{9q^2} = \frac{1}{9}p \)

Percentage decrease in \( p = \frac{1}{9} \frac{q-q}{q} \times 100\% = 88.9\% \)

1(c) \[
x + 2 = \frac{5y - 1}{x} \\
x^2 + 2x = 5y - 1 \\
x^2 + 2x + 1 = 5y \\
(x + 1)^2 = 5y \\
x = -1 \pm \sqrt{5y}
\]

2(a) Monthly rental = \( \frac{1000}{5} \times 4 \)

= $800

2(b) Interest = \( 1000\left(1 + \frac{1.45}{12 \times 100}\right)^{36} - 1000 \)

= $44.43
2(c) Amount borrowed = $5888 \times 70\% \\
= $4121.60
Let the interest rate be \( r \% \).
\[
4121.60 \left(1 + 2 \times \frac{r}{100}\right) = 24 \times 201.31 \\
r = 8.61\% \\
The simple interest rate is 8.61\% p.a.

2(d) Old income in Singapore Dollars = \(\frac{1000}{5} \times 15\) \\
= SGD3000
New Income in Singapore Dollars = 3000 \times 1.23 \\
SGD 3690 : £1900
SGD \frac{3690}{1900} : £1 \\
The exchange rate is £1 = SGD1.94.

2(e) Amount of water bill before GST = 40(1.3)(1.7) + 5.2(1.4)(1.45) \\
= 71.396
Amount of water bill with GST = 71.396 \times 1.07 \\
= $76.39

3(a) Amount paid in 2012 = \(\frac{420}{x}\)

3(b) Amount paid in 2013 = \(\frac{450}{x + 20}\)

3(c) \[
\frac{420}{x} - \frac{450}{x + 20} = 20 \\
420(x + 20) - 450x = 20x(x + 20) \\
420x + 8400 - 450x = 20x^2 + 400x \\
20x^2 + 430x - 8400 = 0 \\
2x^2 + 43x - 840 = 0
\]

3(d) \[
x = \frac{-43 \pm \sqrt{43^2 - 4(2)(-840)}}{2(2)} \\
x = 12.39222 \text{ or } \ x = -33.89222 \\
x = 12.4 \text{ or } \ x = -33.9
3(e) \[ x = -33.9 \text{ rejected } \Rightarrow x > 0 \]
Maximum no. of hours = \[ 12.39222 + 20 \]
\[ = 32.39222 \text{ h} \]
\[ = 32 \text{ hours (nearest hour)} \]

4(a) \[ \angle AOE = \frac{2\pi}{5} \]
\[ = 1.2566 \text{ radians} \]

4(b)(i) Area of \( \Delta AOE = \frac{1}{2} (10^2) \sin 1.2566 \]
\[ = 47.55283 \]
Area of pentagon \( ABCDE = 5 \times 47.55283 \]
\[ = 237.76413 \]
\[ = 238 \text{ cm}^2 \]

4(b)(ii) Area of sector \( AOE = \frac{1}{2} (10^2) \cdot 1.2566 \]
\[ = 62.83 \]
Area of shaded region = \[ 5(62.83) - 237.76413 \]
\[ = 76.4 \text{ cm}^2 \]

5(a)(i) 196 cm

5(a)(ii) Upper quartile = 214 cm
Lower quartile = 178 cm
Interquartile Range = 214 - 178 = 36 cm

5(a)(iii) any value/range that is in 222 - 240 cm

5(b) No. of students at 50\(^{th}\) percentile = 200 students
No. of students at 70\(^{th}\) percentile = 280 students
Probability = \[ \frac{80}{400} \times \frac{79}{399} = \frac{79}{1995} \]

5(c) For school \( Y \),
median = 196 cm
interquartile range = 202 - 190 = 12 cm

Since the interquartile range of School \( Y \) is 12 cm, which is smaller than the interquartile range of School \( X \) at 36 cm, the cumulative frequency curve of School \( Y \) will be than the given curve by the median.

6(a) \( EA = CB \) (rhombus has equal sides)
\( AC \) is the common side
\( \angle EAC = \angle ACB \) (alt \( \angle, \ EA//CB \))
By SAS congruency, \( \triangle ABC \equiv \triangle CEA \).
6(b) \( \triangle FYG \) is similar to \( \triangle BYC \).
\[ \angle FYG = \angle CYB \text{ (vert. opp \( \angle \))} \]
\[ \angle GFY = \angle YBC \text{ (alt \( \angle \), \( FG \parallel CB \))} \]
By AA similarity, \( \triangle FYG \) is similar to \( \triangle BYC \).

\( \triangle FYG \) is similar to \( \triangle CYA \).
\[ \angle CYG = \angle FYG \text{ (common \( \angle \))} \]
\[ \angle YFG = \angle YXA \text{ (corr \( \angle \), \( FG \parallel XA \))} \]
By AA similarity, \( \triangle FYG \) is similar to \( \triangle CYA \).

6(c)(i) \[
\frac{\text{Area of } \triangle AYB}{\text{Area of } \triangle FYC} = \left( \frac{4}{6} \right)^2 = \frac{4}{9}
\]

6(c)(ii) \[
\frac{\text{Area of } \triangle CBY}{\text{Area of } \triangle YAB} = \frac{0.5 \times YC \times h}{0.5 \times AY \times h} = \frac{3}{2}
\]

6(c)(iii) \[
\frac{\text{Area of rhombus } ABCE}{\text{Area of } \triangle CFG} = \frac{2 \times \text{Area of } \triangle ACE}{\text{Area of } \triangle CFG} = 2 \times \left( \frac{10}{15} \right)^2 = \frac{8}{9}
\]

7(a) By cosine rule,
\[ XY^2 = 1.8^2 + 3.2^2 - 2(1.8)(3.2)\cos64^\circ \]
\[ XY = \sqrt{1.8^2 + 3.2^2 - 2(1.8)(3.2)\cos64^\circ} \]
\[ XY = 2.9034 \text{ km (shown)} \]

7(b) By sine rule,
\[ \sin \angle AXY = \sin 66^\circ \]
\[ \frac{1.32}{2.90344} = \frac{1.32 \sin 66^\circ}{2.90344} \]
\[ \angle AYX = 0.41533^\circ \]
\[ \angle AXY = 180^\circ - 66^\circ - 0.41533^\circ = 113.58467^\circ \]

Area of land plot \( AYXB = \frac{1}{2} (3.2)(1.8) \sin 64^\circ + \frac{1}{2} (1.32)(2.90344) \sin 113.58467^\circ \]
\[ = 4.34 \text{ km}^2 \]
7(c) \[ \tan 61^\circ = \frac{3.2}{d} \]
\[ d = \frac{3.2}{\tan 61^\circ} \]
\[ d = 1.77379 \]

Distance from point \( X = 1.77 \text{ km (3 s.f.)} \)

7(d) \[ \sin 80^\circ = \frac{\text{shortest distance}}{4.48} \]
Shortest distance = \( 4.48 \sin 80^\circ \)
\[ = 4.41 \text{ km (3 s.f.)} \]

8(a)(i) \[ |XY| = \sqrt{4 + 25} \]
\[ = \sqrt{29} \]
\[ = 5.39 \text{ units} \]

8(a)(ii) \[ \overrightarrow{OY} - \overrightarrow{OX} = \begin{pmatrix} -2 \\ 5 \end{pmatrix} \]
\[ \overrightarrow{OY} = \begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} -2 \\ 5 \end{pmatrix} = \begin{pmatrix} 1 \\ 6 \end{pmatrix} \]
Coordinates of \( Y = (1, 6) \)

8(b)(i)(a) \[ \overrightarrow{AO} = \mathbf{b} \]
\[ \overrightarrow{AE} = \mathbf{a} + \mathbf{b} \]

8(b)(i)(b) \[ \overrightarrow{BC} = \mathbf{a} + \mathbf{b} \]
\[ \overrightarrow{AB} = 6\mathbf{b} - \mathbf{a} - \mathbf{b} \]
\[ = 5\mathbf{b} - \mathbf{a} \]
\[ \overrightarrow{AF} = \frac{1}{5}(5\mathbf{b} - \mathbf{a}) \]

8(b)(i)(c) \[ \overrightarrow{OF} = \overrightarrow{OA} + \overrightarrow{AF} \]
\[ = -\mathbf{b} + \frac{1}{5}(5\mathbf{b} - \mathbf{a}) \]
\[ = -\frac{1}{5}\mathbf{a} \]

8(b)(ii) \[ \overrightarrow{FE} = 6\overrightarrow{FO} \]
1. \( FE = 6FO \)
2. \( FE \parallel FO \Rightarrow F \) is the common point. \( O, E \) and \( F \) lies on the same line.
9(a)(i) Height = \( \sqrt{15^2 - 6^2} + 7 \)
= \( \sqrt{189} + 7 \)
= 20.748
= 20.7 cm (3 s.f)

9(a)(ii) Outer Surface Area = \( \pi(6)(15) + 2\pi(6)(7) \)
= 546.64
= 547 cm\(^2\)

9(b) Volume = \( \frac{1}{3} \pi(6^2)(13.748) + \pi(6^2)(7) \)
= 1309.9687
= 1310 cm\(^3\)

9(c) Volume of 3 spherical balls = 13 cm\(^3\)
Volume of a spherical ball = \( \frac{13}{3} \) cm\(^3\)

\[ \frac{4}{3}\pi r^3 = \frac{13}{3} \]
\[ r^3 = \frac{13}{4\pi} \]
\[ r = 1.01137 \]
\[ r = 1.01 \text{ cm} \]
Radius = 1.01 cm

10(a) (i)(a) Mean = \( \frac{3(0.6) + 1.2 + 3(1.5) + 1.8 + 1.9 + 5(2.1) + 3.5}{15} \)
= $1.68

10(a)(i)(b) Standard deviation
\[ = \sqrt{\frac{3(0.6^2) + 1.2^2 + 3(1.5^2) + 1.8^2 + 1.9^2 + 5(2.1^2) + 3.5^2}{15} - 1.68^2} \]
= $0.73

10(a)(ii) Median = $1.80

10(a)(iii) The boys generally spend more on lunch per day as the mean amount of money spent by the boys is $2.51, higher than the mean amount of money spent by the girls at $1.68.
10(b)(i) \( P(\text{product} = 0) = 0 \)

10(b)(ii)(a) \( P(\text{at least one of the number is a multiple } 3) = \frac{1}{2} \)

10(b)(ii)(b) \( P(\text{number on } 4\text{-sided die} > \text{number on } 6\text{-sided die}) = \frac{5}{12} \)

11(a) \( a = 261 \)

11(c) Corresponding selling price = $181.82 \pm 5$

Maximum profit = $643.27 \pm 10$

11(d) Gradient = -5.2

11(e)(i) \[
4000S - 42000 = 11S^2 \\
-11S^2 + 4000S - 42000 = 0 \\
- \frac{11}{500}S^2 + 8S - 84 = 0 \\
S = 10.8 \pm 5 \text{ or } S = 352.8 \pm 5
\]

11(e)(ii) The answer in (e)(i) is the selling price of Lady Kaka’s concert ticket in order to break even.

OR

A concert ticket must be sold between $10.80 to $352.80 make a profit.