1(a) $\dfrac{3}{4a^2-25}-\dfrac{2}{5-2a}$

$=\dfrac{3}{(2a-5)(2a+5)}-\dfrac{2}{5-2a}$

$=\dfrac{3}{(2a-5)(2a+5)}+\dfrac{2}{2a-5}$

$=\dfrac{3+2(2a+5)}{(2a-5)(2a+5)}$

$=\dfrac{4a+13}{(2a-5)(2a+5)}$

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

When the value of q is tripled, new q = $3q$.

New $p=\dfrac{k}{(3q)^2}$

$= \dfrac{pq^2}{9q^2}$

$= \dfrac{1}{9}p$

Percentage decrease in p = $\dfrac{\left|\frac{1}{9}q-q\right|}{q}\times 100\%$

= 88.9%

1(c) $x+2=\dfrac{5y-1}{x}$

$x^2+2x=5y-1$

$x^2+2x+1=5y$

$(x+1)^2=5y$

$x=-1\pm\sqrt{5y}$

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

= $800

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

= $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 = 3000×1.23

= SGD 3690

SGD 3690 : £1900

SGD $\frac{3690}{1900}$: £1

The exchange rate is £1= SGD1.94.

2(e) Amount of water bill before GST = $40(1.3)(1.17)+5.2(1.4)(1.45)$

= 71.396

Amount of water bill with GST = 71.396×1.07

= $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) $2x^2+43x-840=0$

$$x=\frac{-43\pm\sqrt{43^2-4(2)(-840)}}{2(2)}$$

$x=12.39222$ or $x=-33.89222$

$x=12.4$ or $x=-33.9$

3(e) $x = -33.9$ rejected $\because x > 0$

Maximum no. of hours = 12.39222 + 20
= 32.39222 h
= 32 hours (nearest hour)

4(a) $\angle AOE = 2\pi \div 5$
$= 1.2566$ radians

4(b)(i) Area of $\Delta AOE = \frac{1}{2}\left(10^2\right)\sin 1.2566$
= 47.55283

Area of pentagon $ABCDE = 5 \times 47.55283$
= 237.76413
= 238 cm^2

4(b)(ii) Area of sector $AOE = \frac{1}{2}\left(10^2\right)1.2566$
$= 62.83$

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, $\Delta ABC \equiv \Delta CEA$.

6(b) ΔFYG is similar to ΔBYC.

$\angle FYG = \angle CYB$ (vert. opp $\angle$)

$\angle GFY = \angle YBC$ (alt $\angle$, $FG // CB$)

By AA similarity, ΔFYG is similar to ΔBYC.

ΔFYG is similar to ΔXYA.

$\angle FYG = \angle XYG$ (common $\angle$)

$\angle YXA = \angle YFG$ (corr $\angle$, $FG // XA$)

By AA similarity, ΔFYG is similar to ΔXYA.

6(c)(i)

$$\frac{\text{Area of } \Delta AYB}{\text{Area of } \Delta FYC} = \left(\frac{4}{6}\right)^2 = \frac{4}{9}$$

6(c)(ii)

$$\frac{\text{Area of } \Delta CBY}{\text{Area of } \Delta YAB} = \frac{0.5 \times YC \times h}{0.5 \times AY \times h} = \frac{3}{2}$$

6(c)(iii)

$$\frac{\text{Area of rhombus } ABCE}{\text{Area of } \Delta CFG} = \frac{2 \times \text{Area of } \Delta ACE}{\text{Area of } \Delta CFG} = 2 \times \left(\frac{10}{15}\right)^2 = \frac{8}{9}$$

7(a) By cosine rule,

$$XY^2 = 1.8^2 + 3.2^2 - 2(1.8)(3.2)\cos 64^\circ$$

$$XY = \sqrt{1.8^2 + 3.2^2 - 2(1.8)(3.2)\cos 64^\circ}$$

$$XY = 2.9034 \text{ km (shown)}$$

7(b) By sine rule,

$$\frac{\sin \angle AXY}{1.32} = \frac{\sin 66^\circ}{2.90344}$$

$$\sin \angle AYX = \frac{1.32 \sin 66^\circ}{2.90344}$$

$$\angle AYX = 0.41533^\circ$$

$$\angle AXY = 180^\circ - 66^\circ - 0.41533^\circ = 113.58467^\circ$$

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) $\tan 61° = \frac{3.2}{d}$

$d = \frac{3.2}{\tan 61°}$

$d = 1.77379$

Distance from point $X = 1.77$ km (3 s.f.)

7(d) $\sin 80° = \frac{\text{shortest distance}}{4.48}$

Shortest distance = $4.48 \sin 80°$

= 4.41 km (3 s.f.)

8(a)(i) $\left|\overrightarrow{XY}\right| = \sqrt{4+25}$

$= \sqrt{29}$

= 5.39 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. $FE \,//\, FO \Rightarrow F$ 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

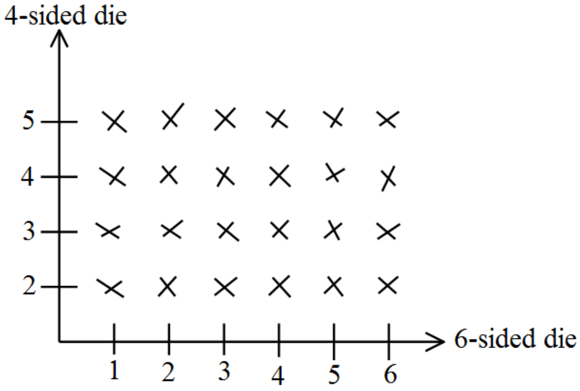
$$= \sqrt{\frac{3(0.6^2) + 1.2^2 + 3(1.5^2) + 1.8^2 + 1.9^2 + 5(2.1^2) + 3.5^2}{15} - 1.68^2}$$

= \$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)



10(b)(ii)(a) P(product = 0) = 0

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

10(b)(ii)(c) P(number on 4-sided die > number on 6-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)

$$4000S - 42000 = 11S^2$$

$$-11S^2 + 4000S - 42000 = 0$$

$$-\frac{11}{500}S^2 + 8S - 84 = 0$$

$S = 10.8 \pm 5$ 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.