2009 NSW BOS General Mathematics Solutions

Section I

1	2	3	4	5	6	7	8
C	**C**	**C**	**A**	**D**	**A**	**A**	**D**

9	10	11	12	13	14	15	16
C	**B**	**B**	**C**	**B**	**D**	**D**	**A**

17	18	19	20	21	22	-	-
C	**B**	**B**	**B**	**D**	**A**	-	-

Q1 C

Q2 Time in the car park = 3 hours 20 minutes. Pay \$18. C

Q3 No mean, median and range for categorical data. C

Q4 $\cos\theta = \frac{8}{x},\ x = \frac{8}{\cos\theta}$ A

Q5 D

Q6 Number of years = $2009 - 1984 = 25$, $3\% = 0.03$, compounded annually. A

Q7 $\binom{4}{2} = 6$ A

Q8 $\frac{90}{75+90} \times 100\% \approx 55\%$ D

Q9 5 out of 20 numbers are less 6, $\frac{5}{20} \times 120 = 30$ C

Q10 Let \$$x$ be the normal hourly rate.
$35x + 5 \times 2x = 561.60,\ 45x = 561.60,\ x = 12.48$ B

Q11 Area of quarter-circle $= \frac{1}{4} \times \pi r^2 = \frac{1}{4} \times \pi 8^2 \approx 50.3\ \text{cm}^2$

Area of triangle $= \frac{1}{2} \times 4 \times 4 = 8\ \text{cm}^2$

Shaded area $= 50.3 - 8 \approx 42\ \text{cm}^2$ B

Q12 $0.0075\ \text{m}^2 = 0.0075 \times (100\ \text{cm})^2 = 75\ \text{cm}^2$ C

Q13 Average % change over 6 months
$= \frac{18000 - 50000}{50000} \times 100\% = -64\%$

Average % change per month $\frac{-64\%}{6} \approx -11\%$

Decrease by 11%. B

Q14 Straight line gradient of 6 means when x increases by 1, A increases by 6. $\therefore$ when x increases by 2, A increases by $2 \times 6 = 12$. D

Q15 $v = \frac{3mn^2}{r},\ n^2 = \frac{rv}{3m},\ n = \pm\sqrt{\frac{rv}{3m}}$ D

Q16 $t \propto \frac{1}{v}$ A

Q17 Number of weeks $= 35 \times 52 = 1820$

Interest rate per week $= \frac{0.08}{52}$ C

Q18 $\frac{20}{x} = \frac{8}{36},\ x = \frac{20 \times 36}{8} = 90$ B

Q19 Radius 0f cylinder $= \frac{12}{2} = 6$ cm

Height of cylinder $= 2 \times 12 = 24$ cm

Volume of cylinder $= \pi r^2 h = \pi \times 6^2 \times 24 \approx 2714\ \text{cm}^3$ B

Q20 Loan amount $= 3499 - 1000 = \$2499$

Total of instalments $= 135.36 \times 24 = \$3248.64$

Interest $= 3248.64 - 2499 = \$749.64$

Simple interest rate p. a. $= \frac{749.64}{2 \times 2499} \times 100\% \approx 15\%$ B

Q21 Total before inclusion $= 14 \times 10 = 140$

Total after inclusion $= 16 \times 12 = 192$

Sum of the two additional scores $= 192 - 140 = 52$

Mean of the two additional scores $= \frac{52}{2} = 26$ D

Q22 ΔDAC is isosceles, $\therefore \angle A = \frac{180 - 80}{2} = 50°$

$\therefore \angle ABD = 180 - (50 + 60) = 70°$

The sine rule: $\frac{AB}{\sin 60°} = \frac{30}{\sin 70°},\ AB = \frac{30 \sin 60°}{\sin 70°} \approx 28$ cm A

Section II

Q23ai Height of building $= 25 \tan 38° = 19.5$ m

Q23aii Angle of depression $= \tan^{-1}\left(\frac{19.5}{62}\right) \approx 17°$

Q23bi $10^4 = 10000$

Q23bii Number of permutation $= 2\times10^3$,
probability $= \dfrac{1}{2\times10^3} = 0.0005$.

Q23ci Area of the two squares − area of the overlapping square
$= 2\times2.7^2 - 0.9^2 = 13.77\text{ m}^2$.

Q23cii $13.77 + 10\%\times13.77 = 15.147\text{ m}^2$, $\therefore$ 16 boxes are required. Total cost $= \$55\times16 = \$880$.

Q23di $4 + 0.30\times5 + 0.50\times2 + 0.50\times4 + 2.00\times2 = \$12.50$.

Q23dii Let $\$x$ be the maximum withdrawal fees.
$x + 4 = 7$, $x = 3.00$

Q24ai 78 has the highest frequency, it is the mode.

Q24aii The median $= \dfrac{45+47}{2} = 46$, which is in the middle of the ordered data set.

Q24bi 8 million dollars.

Q24bii Total profit $= 5 - 1 = 4$ million dollars.

Q24c Possible decision: closure of a school in the area.
Justification: Not enough school age children living in the area.

Q24di $y = 200 - x$

Q24dii In any week, the maximum number of pairs of boots made is $x_{\max} = 120$, and the number of pairs of sandals made is $y_{\max} = 150$.

Q24diii At B, profit $= 24\times50 + 15\times150 = \$3450$.
At C, profit $= 24\times120 + 15\times(200-120) = \$4080$.
The profit at C is greater than the profit at B by $4080 - 3450 = \$630$.

Q24ei $\dfrac{3600}{3} = \$1200$

Q24eii The computer retains 70% of its previous year value. 70% of a non-zero value > 0. $\therefore$ it would never be worth nothing, assuming that nothing means exactly zero.

Initial value \$3600; a year later $3600\times\dfrac{70}{100}$, another year later $3600\times\left(\dfrac{70}{100}\right)^2$, another year later $3600\times\left(\dfrac{70}{100}\right)^3$, etc.

Q5a $5 - 2(x+7) = 5 - 2x - 14 = -2x - 9$

Q25b $50\text{ mg} = 50\times10^{-3}\text{ g}$
Mass of each microbe $= \dfrac{50\times10^{-3}}{2.5\times10^6} = 2.0\times10^{-8}\text{ g}$

Q25ci $A \approx \dfrac{h}{3}(d_f + 4d_m + d_l)$
$= \dfrac{12}{3}(0 + 4(35+20-22-5) + (35+20-30-10)) = 508\text{ m}^2$

Q25cii Volume of water $= 508\times0.60 = 304.8\text{ m}^3 = 304800\text{ L}$.
Number of times $= \dfrac{304800}{4} = 76200$.

Q25di z-score of $-1 = 25.8 - 4.2 = 21.6\,°\text{C}$.

Q25dii 21.6°C and 38.4°C correspond to $\mu - \sigma$ and $\mu + 3\sigma$ respectively.
Required $\% = \dfrac{68\%}{2} + \dfrac{99.7\%}{2} = 83.85\%$

Q26ai IQR for boys $= 6 - 2 = 4$

Q26aii 75%

Q26aiii Same number of boys and girls in the school.

Q26bi $135 + 105 = 240$, $\dfrac{240}{360}\times24 = 16$ hours

Q26bii Wind the clock forward by 16 hours, 1 pm Tuesday.

Q26biii Wind the clock backward by 16 hours, 6 pm Wednesday. 14 hours later, 8 am Thursday.

Q26ci $2200\times12\times20 = \$528000$

Q26cii $A = 299300\times\dfrac{6}{12\times100} = \$1496.50$
$B = 299300 + 1496.50 - 2200 = \$298596.50$

Q26ciii(1) $N = M\left\{\dfrac{(1+r)^n - 1}{r(1+r)^n}\right\}$,
$300000 = M\left\{\dfrac{\left(1+\frac{6}{12\times100}\right)^{240} - 1}{\frac{6}{12\times100}\left(1+\frac{6}{12\times100}\right)^{240}}\right\}$.

Q26ciii(2) $300000 = M\left\{\dfrac{1.005^{240} - 1}{0.005\times1.005^{240}}\right\}$,
$M = \$2149.29$.

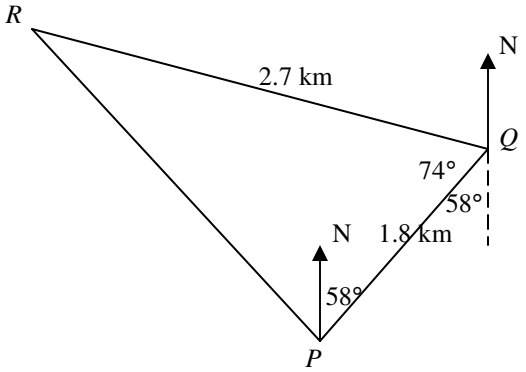
Q27ai $6.4684 \times 5000 = \$32342$

Q27aii $\dfrac{407100}{8.1420} = \$50000$

Q27aiii $A = M\left\{\dfrac{(1+r)^n - 1}{r}\right\} = 1000\left\{\dfrac{(1+0.01)^8 - 1}{0.01}\right\} = \$8285.67$

Interest $= 8285.67 - 1000 \times 8 = \$285.67$.

Q27bi



True bearing of $180 + 58 + 74 = 312°$

Q27bii $RP = \sqrt{2.7^2 + 1.8^2 - 2 \times 2.7 \times 1.8 \cos 74°} \approx 2.8$ km

Q27biii Area $= \dfrac{1}{2} \times 2.7 \times 1.8 \times \sin 74° \approx 2.34$ km^2

Q27c For Mary, $\Pr(at\_least\_one) = \Pr(one) + \Pr(two)$

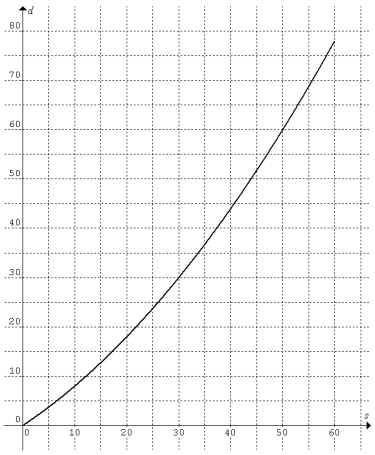
$= \dfrac{2}{100} + 0 = 0.02$.

For Jane, $\Pr(at\_least\_one) = \Pr(one) + \Pr(two)$

$= \left(\dfrac{1}{100} \times \dfrac{99}{100} + \dfrac{99}{100} \times \dfrac{1}{100}\right) + \dfrac{1}{100} \times \dfrac{1}{100} = 0.0199$.

$\therefore$ Mary has the better chance.

Q28ai



Q28aii When $s = 40$, $d = 44$; when $s = 70$, $d = 98$.
Difference in $d = 98 - 44 = 54$ metres.

Q28bi Strong, positive.

Q28bii Select 2 points on the line of best fit: $(80,10.4)$, $(40,1.2)$.

Gradient $= \dfrac{10.4 - 1.2}{80 - 40} = 0.23$.

$\therefore M = 0.23H + c$, $\therefore 1.2 = 0.23 \times 40 + c$, $\therefore c = -8$.

Hence $M = 0.23H - 8$.

Q28c $h \propto d^2$, where h is the height above the ground, in metres, of a person's eyes, and d is the distance, in kilometres, that the person can see to the horizon.

$\therefore h = kd^2$, where k is the constant of proportionality.

$\therefore 1.6 = k \times 4.5^2$, and hence $k = 0.079$.

When $d = 15$, $h = 0.079 \times 15^2 \approx 17.8$ m.

Q28d The sample space is the set of differences, i.e. $\{0,1,2,3,4,5\}$.

In the following table, frequency $= 18 \times$ probability.

Difference	0	1	2	3	4	5
Probability	6/36	10/36	8/36	6/36	4/36	2/36
Frequency	3	5	4	3	2	1

Juan is correct.

Please inform mathline@itute.com re conceptual, mathematical and/or typing errors.