2011 NSW BOS General Mathematics Solutions

Section I

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

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

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

Q1 A prism has a uniform cross-section. D

Q2 $0 \le \Pr \le 1$ A

Q3 B

Q4 $\frac{h}{15} = \tan 40°$, $h = 15\tan 40° \approx 13$ C

Q5 $3 \times 2 \times 1 = 6$ B

Q6 $a^x = 1$ when $x = 0$ D

Q7 B

Q8 D

Q9 $L^2 = 12^2 + (11-2)^2 = 225$, $L = 15$ C

Q10 $\textit{Number of days} = 39$

$I = P\ rn = 2100 \times \frac{0.1974}{365} \times 39 = 44.29$

$\textit{Amount} = 2100 + 44.29 = 2144.29$ C

Q11 X: $\textit{mode} = 9$, $\textit{range} = 9 - 3 = 6$

Y: $\textit{mode} = 8$, $\textit{range} = 11 - 5 = 6$ B

Q12 $\frac{6x^2 y}{3} \div \frac{2y}{5} = \frac{6x^2 y}{3} \times \frac{5}{2y} = 5x^2$ A

Q13 $\textit{Area} \approx \frac{3}{3}(5 + 4\times 7 + 12) + \frac{3}{3}(12 + 4\times 8 + 10) = 99$ A

Q14 Two scores lower than the median and two scores higher than the median are added, the median remains the same. B

Q15 The tosses are independent. The probability that a tail is obtained remains $\frac{1}{2}$ on each toss. B

Q16 $n = 26 \times 3 = 78$, $r = \frac{0.09}{26}$ D

Q17 *The mean height of the first 5 players*

$= \frac{1}{5}(1.8 + 1.83 + 1.84 + 1.86 + 1.92) = 1.85$

The mean height of the 6 players

$= \frac{1}{6}(h + 1.85 \times 5) = 1.85 + 0.01$, $h = 1.91$ C

Q18 $s = ut + \frac{1}{2}at^2$, $\frac{1}{2}at^2 = s - ut$, $a = \frac{2(s-ut)}{t^2}$ A

Q19 $\textit{Total pay} = 22.35 \times 40 + 150 + 22.35 \times 2 \times (5+4) = 1446.30$ D

Q20 $50000 - 20000 = 30000$ C

Q21 $\textit{Distance} = 90 \times (5-3) = 180$

$\textit{Average speed of the second train} = \frac{180}{1\frac{1}{3}} = 135$ A

Q22 Month 3: $P + I - R = 251032.04 - 1871.94 = 249160.10$

Month 4: $I = \frac{0.0765}{12} \times 249160.10 = 1588.40$

Total interest

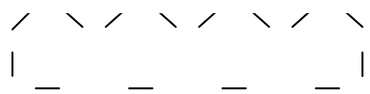
$= 1593.75 + 1591.98 + 1590.19 + 1588.40 = 6364.32$ A

Section II

Q23a $\textit{Taxable income} = 56350 - (350 + 2000 + 250) = 53750$

$\textit{Medicare levy} = 0.015 \times 53750 = 806.25$ dollars

Q23bi



Q23bii $t_{100} = 5 + (100-1)\times 3 = 302$ sticks

Q23biii $543 = 5 + (n-1)\times 3$, $538 = 3(n-1)$, $n - 1 = 179.333......$

$n = 180.333......$ not a whole number, .: not possible

Q23c There are 6 six-month periods in 3 years.
Interest rate per period is 5%.
$1.340 \times 5000 = 6700$ dollars

Q23di $\textit{Volume}\ (\text{m}^3) = \frac{10000}{1000} = 10$

Q23dii *Length = volume ÷ cross-sectional area*

$= \frac{10}{\pi \times \frac{1.5}{2} \times \frac{1.34}{2}} = 6.33$ m

Q24ai 900 mm

Q24aii 2000 mm by 2000 mm

Q24aiii $AB = 6485 + 3690 - 2\times 240 = 9695$ mm

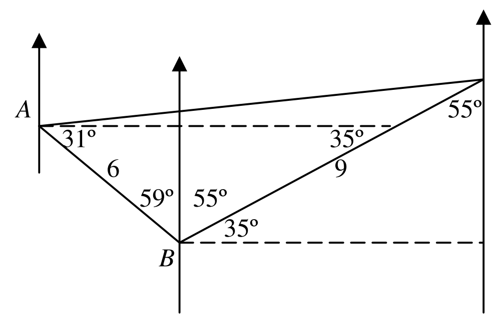
Q24aiv The plan is drawn to scale. Use a ruler to measure the width of a window in the drawing. By proportion the width of each window is 1815 mm.

Q24bi $A = 72 - (16 + 11 + 8 + 12 + 15) = 10$

Q24bii $Relative\ frequency = \frac{8}{72} = \frac{1}{9}$

Q24biii $Expectation = np = 72\times\frac{1}{6} = 12$, .: 5

Q24ci



Bearing of C from B is $55°$.

Q24cii $AC = \sqrt{6^2 + 9^2 - 2(6)(9)\cos 114°} \approx 12.6857 \approx 13$ km

Q24ciii $\frac{\sin\angle ACB}{6} = \frac{\sin 114°}{12.6857}$, $\angle ACB \approx 25.6°$

$Bearing\ of\ A\ from\ C \approx 180 + 55 + 25.6 \approx 261°$

Q25ai Categorical data

Q25aii How many times do you use your mobile phone each day?

Q25aiii Take samples separately from male and female students.

Q25aiv All NSW high school students

Q25bi Year 12 students: 100%

Q25bii Year 9: $\frac{55}{70} = \frac{330}{420}$ Year 10: $\frac{50}{60} = \frac{350}{420}$

.: the year 10 student

Q25biii Percentage of students with mobile phones increases with year group.

Q25ci $319 + 261 = 580$ students

Q25cii $\frac{172}{319}$

Q25ciii $\frac{103+10}{261+10}\times 100\% \approx 42\%$

Q25di 71 is the outlier.

Q25dii Female: $IQR = Q_U - Q_L = 20 - 11 = 9$

Q26ai $X = 2 + 3 = 5$

Q26aii Equally likely outcomes: $\Pr(score < 4) = \frac{6}{12} = \frac{1}{2}$

Q26aiii $\Pr(score = 3 \mid B = 2) = \frac{2}{3}$

Q26aiv The given financial outcomes:

Score	<4	$=4$	>4
F. outcomes	0	\$12	–\$3
Probability	1/2	1/3	1/6

$Expectation\ of\ financial\ outcome = 0\times\frac{1}{2} + 12\times\frac{1}{3} - 3\times\frac{1}{6} = 3.50$

$\$3.50 - \$5.00 = -\$1.50$

$Expected\ loss = \$1.50$

Q26bi $t = 6$, $5\times 3^6 = 3645$ too small

Q26bii $t = 7$, $5\times 3^7 = 10935$ too small

$t = 8$, $5\times 3^8 = 32805$ too large

.: it will take 8 years for the population to first exceed 18000.

Q26c $Deposit = 15\%\times 20000 = 3000$ dollars

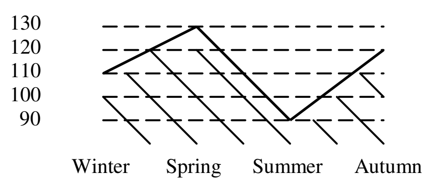
$Amount\ borrowed = 20000 - 3000 = 17000$ dollars

$Interest\ for\ 5\ years = 17000\times 0.19\times 5 = 16150$ dollars

$Total\ amount = 17000 + 16150 = 33150$ dollars

$Monthly\ instalment = \frac{33150}{60} = 552.50$ dollars

Q27a



Q27bi $109° + 160° = 269°$, $360 - 269 = 91°$

Shortest distance $\frac{91}{360} \times 2 \times \pi \times 6400 \approx 10165$ km

Q27bii Rabaul: $Latitude = 0° + 4°S = 4°S$

$160° + 48° = 208°$, $360° - 208° = 152°$

$Longitude = 152°E$

Q27ci Brand B: $z = \frac{400 - 500}{50} = -2$

Q27cii Brand A: $z = \frac{400 - 450}{25} = -2$

The z-scores are equal for the two brands, .: the claim is not correct.

Q27d Josephine: $A = P(1+r)^n = 50000(1+0.06)^{15} = 119827.91$

$Financial\ gain = 119827.91 - 50000 = 69827.91$ dollars

Emma: $A = M\left(\frac{(1+r)^n - 1}{r}\right) = 500\left(\frac{\left(1+\frac{0.06}{12}\right)^{12\times 15}}{\frac{0.06}{12}}\right) = 145409.36$

$Financial\ gain = 145409.36 - 500 \times 12 \times 15 = 55409.36$ dollars

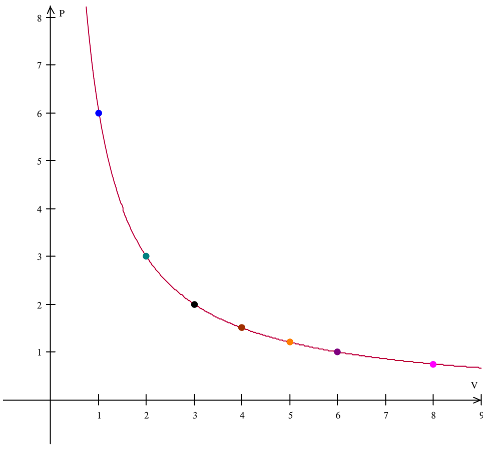
.: Josephine will have the better financial gain after 15 years.

Q28ai $P \propto \frac{1}{V}$, .: $P = \frac{a}{V}$

Q28aii $3 = \frac{a}{2}$, $a = 6$, .: $P = \frac{6}{V}$

When $V = 4$, $P = \frac{6}{4} = 1.5$

Q28aiii



Q28bi $Gradient = \frac{-60000}{15} = -4000$ dollars per year

Q28bii It represents the decrease in the salvage value each year.

Q28biii $S = 60000 - 4000n$

Q28biv n represents the number of years after Norman bought his tractor, .: n cannot be a negative value.

When $n = 15$, $S = 0$, .: n cannot be greater than 15.

.: the values of n that are not suitable for Norman to use are $n < 0$ or $n > 15$

Q28bv $S = V_0(1-r)^n = 60000(1-0.20)^{14} \approx 2638.83$ dollars

Q28bvi For each $n > 15$ the salvage value depreciates by 20% of the previous year's value, and approaches \$0 as $n \to \infty$.

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