2012 NSW BOS General Mathematics Solutions

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Section I

1	2	3	4	5	6	7	8	9
D	**D**	**C**	**A**	**A**	**C**	**D**	**A**	**C**

10	11	12	13	14	15	16	17	18
C	**B**	**B**	**C**	**A**	**D**	**A**	**A**	**D**

19	20	21	22	23	24	25	-	-
B	**C**	**A**	**B**	**D**	**B**	**B**		

Q1 The eighth score from the start, 78 D

Q2 D

Q3 $^6C_2 = 15$ C

Q4 $\frac{x}{29} = \cos 40°$, $x = 29 \times \cos 40°$ A

Q5 $Gradient = \frac{0-p}{q-0} = -\frac{p}{q}$ A

Q6 $Volume = 30 \times 400 \times 5 = 60000 \text{ cm}^3$ C

Q7 $(35.00 - 17.50) \times 1000 = 17500$ D

Q8 Arithmetic sequence: $a = 6$, $d = 2$,
$t_{156} = 6 + (156-1) \times 2 = 316$ A

Q9 4% per annum $= 1\%$ per quarter. 2 years $= 8$ quarters C

Q10 $Area = \frac{1}{2} \times 9.9 \times 8.8 \times \sin(180 - 50 - 57)° \approx 42 \text{ m}^2$ C

Q11 B

Q12 $\Pr(at.least.one) = 1 - \Pr(none) = 1 - \frac{5}{6} \times \frac{5}{6} = \frac{11}{36}$ B

Q13 $A\$60 \approx 46 Euros \approx NZ\$78$ C

Q14 $2x^2(5-x) - x(x-2) = 10x^2 - 2x^3 - x^2 + 2x$
$= -2x^3 + 9x^2 + 2x$ A

Q15 $\frac{t}{6} = \frac{60}{100}$, $t = 3.6$ hours $= 3$ hours 36 minutes D

Q16 A

Q17 $Frequency = 40 - (2 + 4 + 6 + 10 + 12) = 6$,
$relative\ frequency = \frac{6}{40} = \frac{3}{20}$ A

Q18 $119.40 + 402.70 - (300 - 236) \times 0.50 = 490.10$ D

Q19 B

Q20 Use the cosine rule to find $\angle ABC = \theta$:
$31^2 = 80^2 + 59^2 - 2 \times 80 \times 59 \times \cos\theta$,
$\theta = \cos^{-1}\left(\frac{80^2 + 59^2 - 31^2}{2 \times 80 \times 59}\right) \approx 19°$,
∴ bearing of C from B is 161° C

Q21 $E = mc^2 + p$, $mc^2 = E - p$, $c^2 = \frac{E-p}{m}$, $c = \pm\sqrt{\frac{E-p}{m}}$ A

Q22 $Area\ of\ circle = \pi \times 2.4^2 \approx 18.10 \text{ cm}^2$,
$area\ of\ ellipse = \pi \times 2.4 \times (2.4 + 6.3) \approx 65.60 \text{ cm}^2$,
∴ $area\ of\ shaded\ part = 65.60 - 18.10 \approx 48 \text{ cm}^2$ B

Q23 $Interest\ rate\ per\ month = \frac{6\%}{12} = 0.5\% = 0.005$ D

Q24 Monthly repayments:
$Total\ amount\ paid = 2796.86 \times 30 \times 12 = 1006869.60$
Fortnightly repayments:
$Total\ amount\ paid = 1404.76 \times 23 \times 26 = 840046.48$
$Difference = 1006869.60 - 840046.48 = 166823.12$ B

Q25 $A_{hemisphere} = \frac{1}{2} \times 4\pi \times 4^2 = 100.53$
$A_{cylinder} = \pi \times 8 \times 21 = 527.79$
$A_{circle} = \pi \times 4^2 = 50.27$
$TSA = 100.53 + 527.79 + 50.27 \approx 679 \text{ cm}^2$ B

Section II

Q26ai $10 \times 10 \times 10 = 1000$

Q26aii $\frac{1}{10 \times 10} = 0.01$

Q26b $\$22000 \times (1 - 0.15)^3 = \$13510.75$

Q26c Number of days $= 4 + 19 = 23$
$Interest = \$1990 \times 0.20 \times \frac{23}{365} = \$25.08$

Q26di B E C F D A

Q26dii F

Q26ei $\frac{7}{13}$

Q26eii Yes, $\frac{7}{14}=\frac{1}{2}$

Q26f Let x be the 2012 estimated population.

$\frac{60}{x}=\frac{30}{120}$, $x=240$

Let y be the 2008 estimated population.

$240=\left(1-\frac{11}{100}\right)y$, $y\approx 270$

Q26g *Weekly usage* $=9$ cups $=9\times 0.25=2.25$ kg

Number of weeks $=\frac{35}{2.25}\approx 15.6$, $\therefore$ *number of weeks* $=15$

Q27a *Annual take-home pay (net wage)*

$=52\times\$(1024-296.40-24.50-15.80)=\$35739.60$

% of net wage for household expenses

$=\frac{3640}{35739.60}\times 100\%=10.185\%$

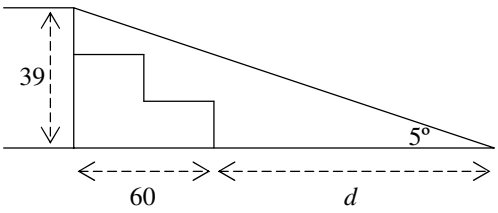
Q27b *Perimeter* $=\frac{230}{360}\times 2\pi\times 13+13+13\approx 78$ cm

Q27ci Scale is $1:500000$, 1 cm : 500000 cm, 1 cm : 5 km

Actual distance $=5\times 2$ km $=10$ km

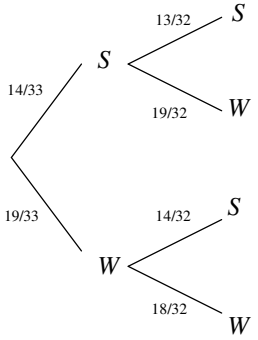
Q27cii *Distance on the map* $=\frac{75}{5}=15$ cm

Q27d



$\frac{39}{60+d}=\tan 5°$, $\frac{60+d}{39}=\frac{1}{\tan 5°}$, $d=\frac{39}{\tan 5°}-60\approx 386$ cm

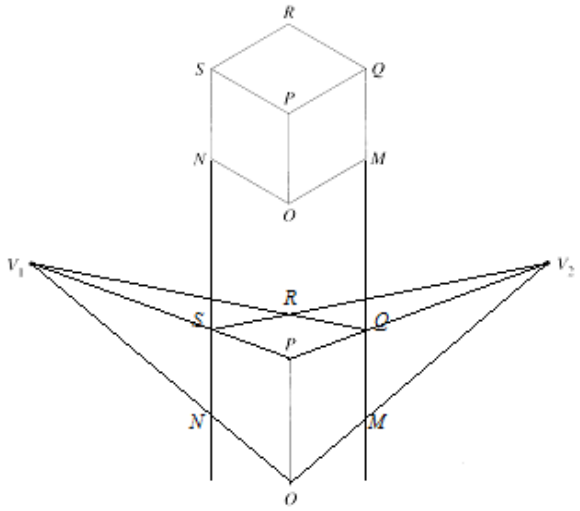
Q27ei



Q27eii $\Pr(SS)=\frac{14}{33}\times\frac{13}{32}=\frac{91}{528}$

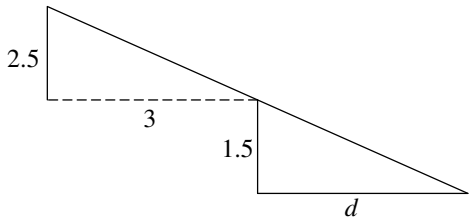
Q27eiii $\Pr(SW)+\Pr(WS)=\frac{14}{33}\times\frac{19}{32}+\frac{19}{33}\times\frac{14}{32}=\frac{133}{264}$

Q28a



Q28b $\frac{18ab}{3a^2}\times\frac{c}{b}=\frac{6c}{a}$

Q28c



Similar triangles: $\frac{d}{1.5}=\frac{3}{2.5}$, $d=1.8$

Q28di English: $IQR=Q_3-Q_1=80-50=30$

Q28dii English is more negatively skewed than Mathematics. The measures of location and spread of the two distributions are determined by the medians and ranges respectively. Mathematics has a higher median (75) than English (70), whilst English has a greater range (85) than Mathematics (40).

Q28e *Total amount paid*

$=\$(0.10\times 2800+95.20\times 36)=\$3707.20$

Interest $=\$3707.20-\$2800=\$907.20$

Annual flat rate of interest $=\frac{907.20}{0.9\times 2800\times 3}\times 100\%=12\%$

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Q29ai Read from graph (vertical line through 4.0 min), 70 min.

Q29aii Read from graph (horizontal line through 60 min), 3.0 min.

Q29aiii There is a positive correlation (it is a linear relationship) between the duration of an eruption and the time to the next eruption.

Q29b $\mu - \sigma = 6.000 - 0.040 = 5.960$

$\mu + \sigma = 6.000 + 0.040 = 6.040$

Two lengths, 5.950 and 6.140, lie outside the interval from 5.960 to 6.040, .: the setting of the machine needs to be checked.

Q29ci $\angle EGF = 180° - 31° - 139° = 10°$

The sine rule: $\frac{EF}{\sin 10°} = \frac{64}{\sin 31°}$, $EF = \frac{64 \sin 10°}{\sin 31°} \approx 22 \text{ km}$

Q29cii $EH^2 + GH^2 = 82^2$, $EH = GH$, $EH^2 + EH^2 = 82^2$,

$2 \times EH^2 = 82^2$, $EH = \sqrt{\frac{82^2}{2}} \approx 58$

Total distance $\approx 22 + 64 + 58 + 58 = 202 \text{ km}$

Q29di Monthly contribution $\frac{\$81600}{12} \times 0.05 = \$340$

Q29dii *Interest rate per month* $= \frac{6.6\%}{12} = 0.55\% = 0.0055$

Number of monthly contributions from the end of Jan 2000 to the end of Dec 2012 $= 12 \times 13 = 156$

Accumulated value $= \frac{\$340 \times \left(1.0055^{156} - 1\right)}{(1.0055 - 1)} \approx \$83633.89$

Q30a The ship and the rescue boat are separated by $9° + 4° = 13°$ on the great circle.

Distance $= 60 \times 13 = 780$ nautical miles

Time of travel $= \frac{780}{30} = 26$ hours

Q30bi *Maximum height reached* $= 40 \text{ m}$

Q30bii *Distance* $= 170 - 30 = 140 \text{ m}$

Q30biii At $d = 250$, $h = 17.5 \text{ m}$

Q30biv $d < 0$ or $d > 300$, because the golf ball starts at point *A* where $d = 0$ and finishes at point *B* where $d = 300$.

Q30ci Year 2030 is $n = 20$, $P = 6600000$

Q30cii $A = 3000000$ represents the population in 2010 $(n = 0)$

Q30ciii1 $1.05 > 1.04$, $b = 1.05$ is not suitable because it corresponds to speeding up of the population growth.

Q30ciii2 Given $n = 20$, $P = 4460000$

b	P
1.03	$3000000 \times 1.03^{20} \approx 5418000$
1.02	$3000000 \times 1.02^{20} \approx 4458000$
1.01	$3000000 \times 1.01^{20} \approx 3661000$

.: $b \approx 1.02$

Q30civ Use $P = 3000000 \times (1.02)^n$

In 2050 $(n = 40)$,

$P = 3000000 \times (1.02)^{40} \approx 6624000 < 7000000$

The city will achieve its aim according to the model.

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