NSW BOS General Mathematics Solutions 2008

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Section I

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

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

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

Q1 $12k^3 \div 4k = \dfrac{12k^3}{4k} = 3k^{3-1} = 3k^2$ A

Q2 Surface area $= (2\times5)\times1 + (3\times5)\times2 + (3\times2)\times2 = 52$ cm^2 C

Q3 Range = Max − min = $67 - x = 43$, $x = 24$, $\therefore N = 4$ A

Q4 $y = 3^x$ is an exponential function. $y = 1$ when $x = 0$. D

Q5 The smallest angle (let it be θ) is opposite to the shortest side of the triangle.
Use the cosine rule: $6^2 = 7^2 + 8^2 - 2(7)(8)\cos\theta$,
$\cos\theta = \dfrac{7^2+8^2-6^2}{2(7)(8)}$, $\theta \approx 47°$ B

Q6 $30001 < 43561 < 45000$
Tax payable $= 5400 + (43561 - 30000)\times0.40 = 10824.40$ B

Q7 Last week pay $= 15\times12\times1.5 = 270$
This week pay $= 15\times x\times2 = 270$, $\therefore 30x = 270$, $x = 9$ D

Q8 When the 33 scores are in order, the median is the 17th score, i.e. 14. C

Q9 $\sqrt{\dfrac{x+2y}{8y}} = \sqrt{\dfrac{5.6+2\times3.1}{8\times3.1}} \approx 0.69$ A

Q10 The boxes have the same width, $\therefore$ the two sets of data have the same interquartile range. D

Q11 Area of the shower floor (excluding the drain)
$= 100\times100 - \pi\times5^2 \approx 9921$ cm^2 B

Q12 The word 'skewed' is used to describe the distribution of a set of data, not the correlation between two sets of data. A

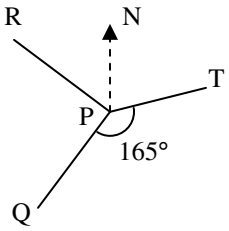
Q13 The average height of the two students must be 160 cm as well. $(149+171)\div2 = 160$ C

Q14 $\dfrac{h}{80} = \sin55°$, $h = 80\sin55° \approx 66$ m B

Q15 Total amount paid on terms
$= 15\%\,of\,16000 + 320\times60 = 21600$
Interest $= 21600 - 16000 = \$5600$ B

Q16 $\Pr(blue) = \dfrac{3}{8} = \dfrac{6}{16}$, i.e. 6 blue marbles out of a total of 16 marbles. D

Q17
Q is SW of P and R is NW of P,
$\therefore \angle RPQ = 90°$ and $\angle RPN = 45°$.
$\therefore \angle NPT = 360° - 45° - 90° - 165° = 60°$



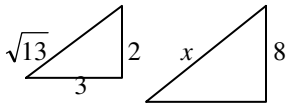
A

Q18 M(letter)(numeral)(numeral)(letter)(letter)
$1\times26\times10\times10\times26\times26 = 26^3\times10^2$ A

Q19 Since $h \propto \sqrt{n}$, $\therefore \dfrac{h_b}{h_a} = \dfrac{\sqrt{n_b}}{\sqrt{n_a}} = \sqrt{\dfrac{n_b}{n_a}}$,

$\therefore \dfrac{h_b}{35} = \sqrt{\dfrac{10000}{2000}} = \sqrt{5}$, $\therefore h_b = 35\sqrt{5} \approx 78$ B

Q20 Similar triangles:



$\dfrac{x}{8} = \dfrac{\sqrt{13}}{2}$, $x = 4\sqrt{13} \approx 14.42$ m D

Q21 $V_{cylinder} : V_{sphere}$
$= \pi r^2 h : \dfrac{4}{3}\pi r^3 = \pi r^2(4r) : \dfrac{4}{3}\pi r^3 = 4\pi r^3 : \dfrac{4}{3}\pi r^3 = 1 : \dfrac{1}{3} = 3:1$ B

Q22 $\Pr(6) = \dfrac{450}{1200} = \dfrac{3}{8}$, $\therefore \Pr(6') = 1 - \dfrac{3}{8} = \dfrac{5}{8}$,
$\therefore \Pr(1) = \Pr(2) = \Pr(3) = \Pr(4) = \Pr(5) = \dfrac{5}{8}\div5 = \dfrac{1}{8}$ C

Section II

Q23ai Feb, Mar, Nov or Dec.

Q23aii In the 4 months in Q23ai, only Nov has average rainfall less than 80 mm. ∴ Nov is the best month if both rainfall and temperature data are considered.

Q23bi Capacity = 1250 ml, correct to the nearest 10 ml.
∴ the capacity is between 1245 and 1254.999… ml,
i.e. 1250 ± 5 ml.

∴ percentage error $= \frac{5}{1250} \times 100\% = 0.4\%$.

Q23ci Volume of alcohol = $5.5\% of 375$ ml

$= \frac{5.5}{100} \times 375 = 20.625$ ml.

Q23cii Rate of alcoholic drink intake
= 1 standard drink per hour

$= \frac{375}{1.6}$ ml per hour

$= \frac{375}{1.6} \div 60$ ml per minute ≈ 3.9 ml per minute.

Q23d $\frac{5x+1}{2} = 4x-7$, $5x+1 = 2(4x-7)$, $5x+1 = 8x-14$,
$15 = 3x$, $x = 5$.

Q23e Length of bar graph = 9 cm,
length of pizza section = 3.5 cm.

Number of people $= \frac{3.5}{9} \times 450 = 175$.

Q23f Mean mark for 4 tests
= (total mark for the first 3 tests + mark, x, for the 4th test) ÷ 4

i.e. $73 = \frac{72 \times 3 + x}{4}$, ∴ $x = 76$.

Q24ai Total sales in a year = $\$15670 \times 12 = \$188040$
Earning per year = $13\% of \$188040 = \$24445.20$

Q24aii Bob should choose Method 2.
Earning per year = $\$350 \times 52 + 4.5\% of \$188040 = \$26661.80$

Q24bi Number of 3-digit numbers = $3 \times 4 \times 5 = 60$.

Q24bii Number of odd ones = $3 \times 4 \times 3 = 36$,

∴ $\Pr(odd) = \frac{36}{60} = \frac{3}{5}$.

Q24biii Number of even ones = $60 - 36 = 24$.

Q24biv 432, 431, 421 and 321 are the only possibilities satisfying the requirements. Probability $= \frac{4}{60} = \frac{1}{15}$.

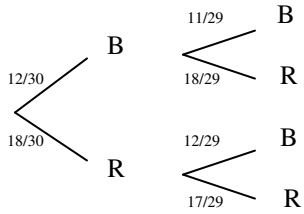
Q24c $A = N(1+r)^n$, where $A = 740000$, $r = \frac{2}{100} = 0.02$ and $n = 40$. ∴ $740000 = N(1.02)^{40}$, ∴ $N = \frac{740000}{1.02^{40}} = \$335138.91$.

Q25ai $a \times 2^t = P$, $a \times 2^2 = 24$, ∴ $a = 6$.

Q25aii $6 \times 2^t = 1500$, $2^t = 250$, $t = \frac{\log(250)}{\log(2)} \approx 7.966$.

∴ it will take 8 years to first exceed 1500.

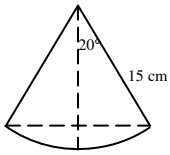
Q25bi



Q25bii $\Pr(same colour) = \Pr(BB or RR)$

$= \Pr(BB) + \Pr(RR) = \frac{12}{30} \times \frac{11}{29} + \frac{18}{30} \times \frac{17}{29} = \frac{73}{145}$.

Q25ci Height of box = radius = 15 cm
Width of box $= 7 \times 3 = 21$ cm
Length of box $= (15 \sin 20°) \times 8 = 41.04$ cm



Q25cii Cross-sectional area of triangular prism

$= \frac{1}{2} \times 15 \times 15 \times \sin 40° = 72.314 \text{ cm}^2$

Volume of triangular prism $= 72.314 \times 7 \approx 506 \text{ cm}^3$

Q26ai

	Aged < 40	Aged ≥ 40	Total
Liked (L)	65	37	102
Did not like (L')	42	31	73
Total	107	A	175

$A = 37 + 31 = 68$.

Q26aii $\Pr(< 40 \cap L') = \frac{42}{175} = \frac{6}{25}$.

Q26aiii $\Pr(L) = \frac{102}{175}$, percentage $= \frac{102}{175} \times 100\% = 58.3\%$. No.

Q26bi Relative frequency $= \frac{35000}{2000000} = 0.0175$

Q26bii The distribution is negatively skewed with 80% of the retirement ages between 61 and 75.

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Q26ci The chance for outcome 4 to occur
$= (100-10-40-30)\% = 20\%$.
Let \$$x$ be the loss in outcome 4.
Expectation of the game $= 0$,
$\therefore 10\% \times 12 + 40\% \times 6 + 30\% \times 3 - 20\% \times x = 0$, $\therefore x = 22.50$.

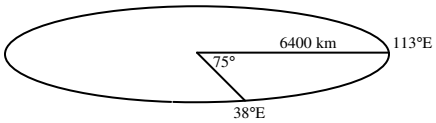
Q26di From graph, $0.6M = 0.6 \times 1000000 = 600000$

Q26dii The modal age group is 35-39.

Q26diii Number of males + number of females
$= 0.7M + 0.7M = 1.4M$

Q26div The 80^+ age group has a greater range in age whilst the 75-79 age group has only a range of 5 years.

Q27ai



$\theta° = 113° - 38° = 75°$.

Distance $= \dfrac{\pi}{180°} r\theta° = \dfrac{\pi}{180°} \times 6400 \times 75° \approx 8378$ km.

Q27aii Time taken $= \dfrac{d}{v} = \dfrac{8378}{913} \approx 9$ hours.

Q27aiii Borneo is ahead of Kenya by $\dfrac{75}{360} \times 24 = 5$ hours.
Kenya time: Departure 10pm Tue; 9 hrs later, arrival 7am Wed.
Borneo time: Departure 3am Wed; arrival 12 noon Wed.

Q27bi Use $N = M\left\{\dfrac{(1+r)^n - 1}{r(1+r)^n}\right\}$,

where $n = 12 \times 30 = 360$, $r = \dfrac{8.25}{100 \times 12} = 0.006875$, $N = 290000$
and M is the monthly repayment.

$\therefore 290000 = M\left\{\dfrac{(1+0.006875)^{360} - 1}{0.006875(1+0.006875)^{360}}\right\}$. $\therefore M \approx \$2178.67$.

Q27bii Total amount paid $= 2178.67 \times 360 = \$784321.20$.

Q27biii $N = 290000$, $r = 0.006875$.
The monthly repayment is increased by \$250,
$\therefore M = 2178.67 + 250 = 2428.67$.

$\therefore 290000 = 2428.67\left\{\dfrac{(1+0.006875)^n - 1}{0.006875(1+0.006875)^n}\right\}$,

$119.4069182 = \dfrac{1.006875^n - 1}{0.006875 \times 1.006875^n}$,

$0.8209225626 \times 1.006875^n = 1.006875^n - 1$,

$0.1790774374 \times 1.006875^n = 1$, $\therefore 1.006875^n = 5.584176402$,

$n = \dfrac{\log(5.584176402)}{\log(1.006875)} = 251.032$ months.

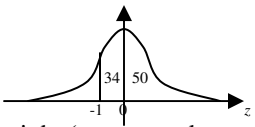
Time required to pay off the loan is $\dfrac{251.032}{12} = 20.92$ years.
Unable to pay off in 20 years.

Q27c Use $S = V_0(1-r)^n$, where $S = 2023$, $n = 2$ and
$r = \dfrac{15}{100} = 0.15$.
$\therefore 2023 = V_0(1-0.15)^2$, $2023 = V_0 \times 0.85^2$, $\therefore V_0 = \$2800$.

Q28ai For 6-year old girl of height 120 cm, $z = 1$.

Q28aii1 If 2.5% of girls are taller than Rachel, Rachel's height must be $\mu + 2\sigma$, $\therefore z = 2$ and Rachel's height is 155 cm.

Q28aii2 At age $15\frac{1}{2}$, Rachel remains 155 cm tall and this corresponds to $z = -1$.
Percentage of girls taller than Rachel
$= 34\% + 50\% = 84\%$.



Q28aiii For 18-year old girls, average height (corresponds to $z = 0$) is 163 cm.

Q28aiv $21 \le B \le 25$, $21 \le \dfrac{m}{h^2} \le 25$, $21 \le \dfrac{m}{1.63^2} \le 25$,
$\therefore 21 \times 1.63^2 \le m \le 25 \times 1.63^2$, i.e. $55.8 \le m \le 66.4$.
Minimum weight is 55.8 kg.

Q28av1 The average height of a girl between 6 and 11 years increases by 6 cm per year.

Q28av2 The given graphs are linear between 6 and 11 years, but not for age older than 12.

Q28bi Simpson's rule: $A = \dfrac{h}{3}(d_f + 4d_m + d_l)$.

A (2 applications) $= \dfrac{h}{3}(0 + 4a + b) + \dfrac{h}{3}(b + 4a + 0) = \dfrac{2h}{3}(4a + b)$.

Q28bii $A = 600$, $4h = 80$, $\therefore h = 20$.
$\therefore 600 = \dfrac{2 \times 20}{3}(4a + b)$, $\therefore 4a + b = 45$, $\therefore b = 45 - 4a$.
If a increases by 2 m, b decreases by 8 m.

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

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