2014 NSW BOS Mathematics General 2 Solutions

Section I

1	2	3	4	5	6	7	8	9
D	B	C	B	B	D	D	C	C

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

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

Q1 Call time $= 10 + 7 = 17$ min. $\therefore$ cost $= \$16$ D

Q2 New measurement $= 72 \times 1.20 \times 0.80 \approx 69$ cm B

Q3 It could be the graph of a quadratic translated 1 unit upwards. C

Q4 $\text{Dosage} = \dfrac{1.5 \times 45}{1.5 + 12} \times 4 = 20\,\text{mL}$ B

Q5 1 gigabite $= 2^{30}$ bites $= \dfrac{2^{30}}{2^{10}}$ kilobites

2 gigabites $= \dfrac{2^{30}}{2^{10}} \times 2 = 2^{21}$ kilobites B

Q6 $3 \times 5 \times 2 = 30$ D

Q7 D

Q8 $\Pr(\text{not owning a mobile} \mid \text{male}) = \dfrac{28}{70}$ C

Q9 $S = V_o(1-r)^n = 19990(1-0.18)^3 \approx 11022$ C

Q10 $\text{Percentage error} = \dfrac{0.05}{138.4} \times 100\% = 0.036\%$ A

Q11 $6w^4 \times \dfrac{1}{3}w^2 = 2w^{4+2} = 2w^6$ A

Q12 $\text{Area} = \pi(3+1.5)^2 - \pi 3^2 \approx 35.3\,\text{m}^2$ C

Q13

$\text{Commission} = 0.06 \times 2000 + 0.035 \times 1000 + 0.02(5670 - 3000)$

$= 208.40$ dollars B

Q14 $\text{Mean} = \dfrac{1 \times 5 + 4 \times 10 + 7 \times 3 + 10 \times 2}{20} = 4.3$ B

Q15 55° between 20° S and 35° N B

Q16 $\Pr(rr) = \dfrac{8}{31} \times \dfrac{8}{31}$ D

Q17 $\text{Amount required} = 15 \times \dfrac{14}{2} = 105\,\text{mg}$ or x mL

$x : 105 = 10 : 120$, $x = \dfrac{10}{120} \times 105 = 8.75$ B

Q18 $90340 \times 0.25 \times 50 = 1129250\,\text{L} = 1129.25\,\text{kL}$ A

Q19 A

Q20 $\text{Time of use per day} = 13 \times 4 = 52\,\text{minutes} = \dfrac{52}{60}\,\text{h}$

$\text{Electricity used} = 9\,\text{kW} \times \dfrac{52}{60}\,\text{h} = 7.8\,\text{kWh}$

$\text{Cost} = 11.97 \times 7.8 \times 7 = 653.562\,\text{cents} \approx \$6.54$ B

Q21 $\text{Future value} = 25000 \times 4.1216 = \$103040$ C

Q22 $\text{Fuel used} = \dfrac{8.9\,\text{L}}{100} \times 65 + \dfrac{6.6\,\text{L}}{100} \times (560 - 65) \approx 38\,\text{L}$ B

Q23 C

Q24 2.75 kg and 4.15 kg are 1σ lower and 3σ higher than the mean.

% of newborn between 2.75 kg and 4.15 kg

$= \dfrac{1}{2} \times 68\% + \dfrac{1}{2} \times 99.7\% = 83.85\%$

Number of newborn $= 83.85\%$ of $10000 = 8385$ D

Q25 $\text{Area} = \dfrac{1}{2}\left(4\pi \times 24^2\right) + \pi \times 48 \times 30 \approx 8143\,\text{m}^2$ A

Section II on next page

Section II

Q26a $4x\left(7x^4 - x^2\right) = 28x^5 - 4x^3$

Q26b $h = \dfrac{5}{\sin 28°} \approx 10.65$

Q26c $\dfrac{5x+1}{3} - 4 = 5 - 7x$, $\dfrac{5x+1}{3} = 9 - 7x$, $5x + 1 = (9 - 7x)3$

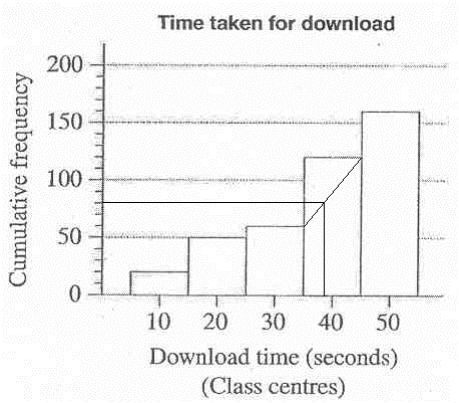
$5x + 1 = 27 - 21x$, $26x = 26$, $x = 1$

Q26d $y = 2x + 1$ …… (1) $\quad x - 2y - 4 = 0$ …… (2)

By substitution: $x - 2(2x+1) - 4 = 0$, $x - 4x - 2 - 4 = 0$

$\therefore\ x = -2$ and $y = -3$

Q26e



Q26f $w_{moon} \propto w_{Earth}$, $w_{moon} = kw_{Earth}$, $k = \dfrac{w_{moon}}{w_{Earth}} = \dfrac{14}{84} = \dfrac{2449}{x}$,

where $x = 14694$ kg is the weight of the landing craft on Earth.

Q26g $151° - 104° = 47°$

Time difference $= 24 \times \dfrac{47}{360} \approx 3.13$ h, i.e. 3 h

Q27ai $13380 is taken as $13400 for calculation of Stamp Duty.

Stamp Duty $= \$3 \times \dfrac{13400}{100} = \$402$

Q27aii Total amount borrowed $= 13380 + 30 + 402 = \$13812$

Interest $= 13812 \times 0.075 \times 3 = \$3107.70$

Monthly repayment $= \dfrac{13812 + 3107.70}{36} \approx \$470$

Q27aiii Total of base rate and FSL $= 845 + 845 \times 0.01 = \$853.45$

Stamp Duty $= 853.45 \times 0.055 \approx \$46.95$

GST $= 853.45 \times 0.10 \approx \$85.35$

Total amount to be paid $= 853.45 + 46.95 + 85.35 = \$985.75$

Q27aiv Comprehensive car insurance covers damage to one's own vehicle, loss of vehicle or property, theft and damage to other people's property such as their vehicle.

Q27b By bus: $\dfrac{36.40}{10} = \$3.64$ per trip

By motorcycle: $1.67 \times \dfrac{34}{17} = \$3.34$ per trip

$\therefore$ travelling by motorcycle is cheaper by 30 cents.

Q27c Area of the base $= (140 - 56) \times 56 + \pi\left(\dfrac{56}{2}\right)^2 \approx 7167 \text{ cm}^2$

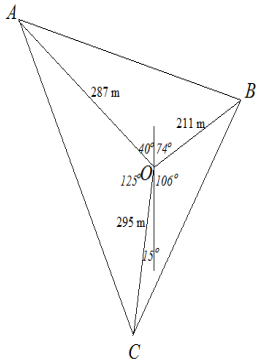
Volume $= 7167 \times 81 \approx 580528 \text{ cm}^3$ $\quad$ Capacity $= \dfrac{580528}{1000} \approx 581 \text{ L}$

Q28a Winning expectation $= 5.00 \times \dfrac{1}{3} + 0.50 \times \dfrac{1}{3} + 0.50 \times \dfrac{1}{3} = 2.00$

Financial expectation $= 2.00 - 2.00 = 0$

Q28bi

$\angle AOB = 40° + 74° = 114°$



Q28bii The cosine rule:

$AB = \sqrt{287^2 + 211^2 - 2(287)(211)\cos 114°}$

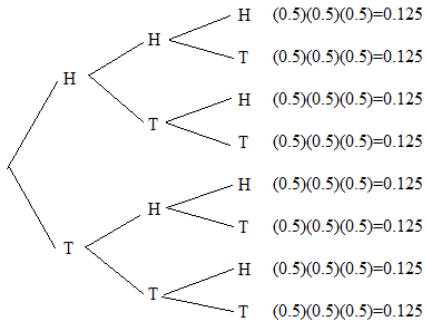
≈ 420 m

Q28biii Area of ΔAOB

$= \dfrac{1}{2}(287)(211)\sin 114°$

$\approx 27661 \text{ m}^2 \approx 2.8$ ha (2 sig. fig.)

Q28c



$\Pr(2 \text{ heads and a tail}) = 0.125 \times 3 = 0.375$

Q28di $AB \approx 8.0$ cm measured from the exam page.

$\therefore$ 8.0 cm : 50 m, the scale is $1 \text{ cm} \approx \dfrac{50 \text{ m}}{8.0}$, i.e. $1 \text{ cm} = 6.25$ m approx.

Q28dii $XY \approx 5.1$ cm

Actual length of $XY \approx 5.1 \times 6.25 \approx 31.9$ m

Q28diii The five given widths are separated by approximately the same distance of $\dfrac{50}{4} = 12.5$ m

Estimated area of the pool

$= \dfrac{12.5}{3}(21.88 + 4(25.63) + 31.88) + \dfrac{12.5}{3}(31.88 + 4(36.25) + 21.88)$

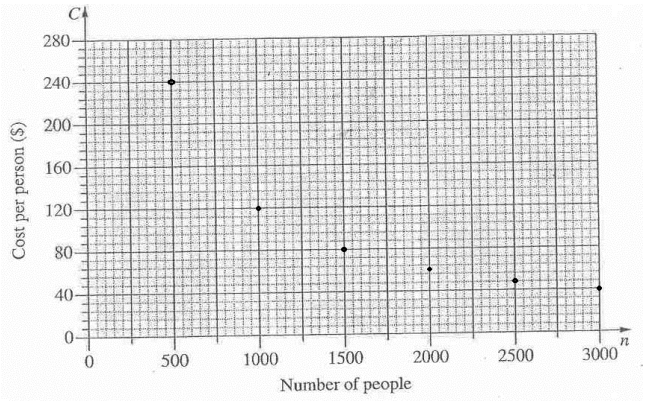
$\approx 1479.3 \text{ m}^2$

Approximate volume of the pool $= 1479.3 \times 1.2 \approx 1800 \text{ m}^3$

Q29ai

Number of people (n)	500	1000	1500	2000	2500	3000
Cost per person (C)	240	120	80	60	48	40

Q29aii



Q29aiii $C = \dfrac{120000}{n}$

Q29aiv n is a whole number.

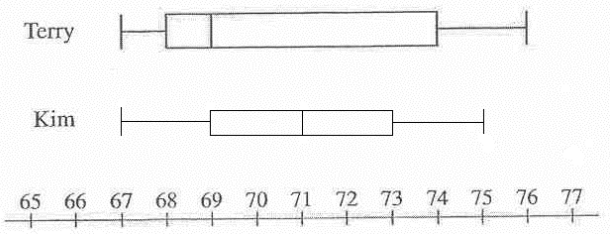
Q29av $94 = \dfrac{120000}{n}$, $n \approx 1276.6$ which is not a whole number,

.: not possible

Q29b For male, $BAC = \dfrac{10N - 7.5H}{6.8M} = \dfrac{10N - 7.5(4)}{6.8(84)} < 0.05$

.: $N < 5.856$, hence maximum N is 5.

Q29ci



Q29cii 69 was the median of Terry's results, .: 50%

Q29ciii Incorrect.
Terry's results were positively skewed. The top 50% of the results spread over the interval 69 – 76.
Kim's results were symmetric. The top 75% of the results spread over the interval 69 – 75.
.: The average of Kim's test results was higher than the average of Terry's results.

Q30a $A = P(1+r)^n$, $20000 = P\left(1 + \dfrac{3}{12 \times 100}\right)^{15 \times 12}$,

$20000 = P(1.0025)^{180}$, .: $P = \$12760$

Q30bi This indicates a strong positive linear relationship between expenditute per primary school student and life expectancy for the 15 countries.

Q30bii $IQR = Q_U - Q_L = 22.5 - 8.4 = 14.1$

Q30biii $Q_U + 1.5 \times IQR = 22.5 + 1.5 \times 14.1 = 43.65$

$47.6 > 43.65$, .: it would be an outlier of the set of data.

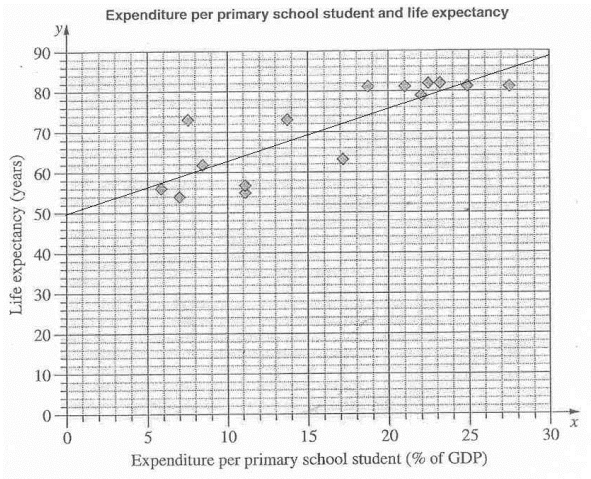
Q30biv $\bar{x} = 16.14$, $\sigma_x = 7.03$

Q30bv $m = r \times \dfrac{\sigma_y}{\sigma_x} = 0.83 \times \dfrac{10.94}{7.03} \approx 1.29$

y-intercept $= \bar{y} - m\bar{x} = 70.73 - 1.29 \times 16.14 \approx 49.9$

.: least-squares line is $y = 1.29x + 49.9$

Q30bvi



Q30bvii $y = 1.29x + 49.9$, $y = 1.29(18) + 49.9 \approx 73.1$ years

Q30bviii The line is based on the set of data from 5% to 28%, and it is useful for values close to 28%. 60% is too far beyond 28% to give a reliable extrapolation.

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