

2022 NSW ESA Mathematics Standard 2 Solutions © itute 2022

Section I

|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| C | A | B | D | D | B | C | C | A | B  | D  | B  | B  | A  | C  |

Q1 C

Q2 Negative gradient, positive y-intercept. A

Q3 B

Q4  $\frac{30}{x} \approx \frac{12}{40}, x \approx 100$  D

Q5 D

Q6 20 minutes :  $\frac{1}{3}$  day =  $\frac{1}{3}$  hour :  $\frac{1}{3} \times 24$  hours = 1 : 24 B

Q7  $5 \times (9 \times \$20.45 + \$16.20) = \$1001.25$  C

Q8  $48^\circ + 180^\circ = 228^\circ$  C

Q9  $10 - 6 = 4$  seconds A

Q10 Profit =  $800 \times (\$3.40 - 2.60) - \$24.95 = \$615.05$  B

Q11  $FV = PV(1+r)^n, n = 2 \times 10 = 20, r = \frac{1}{2} \times 4\% = 2\% = 0.02$   
 $\therefore PV = \frac{FV}{(1+r)^n} = \frac{150000}{(1+0.02)^{20}}$  D

Q12 B

Q13  $0.9738 - 0.5 = 0.4738$  B

Q14 A

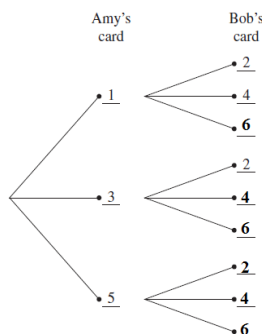
Q15 C

Section II

Q16a Maximum heart rate =  $220 - 25 = 195$  bpm

Q16b  $50\% \times 195 = 97.5, 85\% \times 195 = 165.75$   
 Between 97 and 165 bpm (inclusive)

Q17a



$\Pr(\text{Bob wins}) = \frac{6}{9} = \frac{2}{3}$

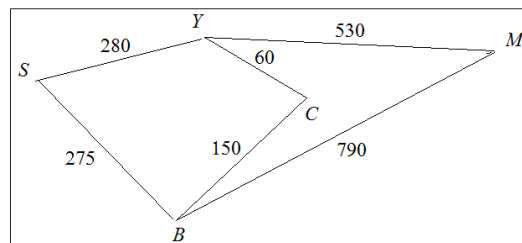
Q17b  $\frac{2}{3} \times 30 = 20$  times

Q18  $90 = 60 + 2 \times 15 \therefore \% \text{ higher than } 90 \text{ is } \frac{100\% - 95\%}{2} = 2.5\%$

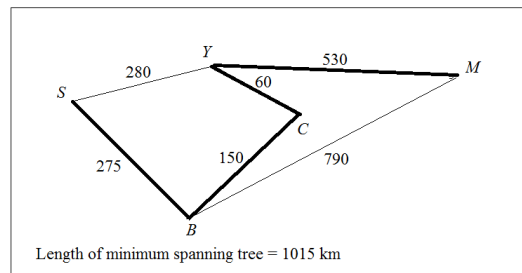
Q19a  $A = 98 + 62 = 160, B = \frac{192}{200} \times 100 = 96$

Q19b The first two on the Pareto chart, i.e. Stock shortage and Delivery fee.

Q20a



Q20b

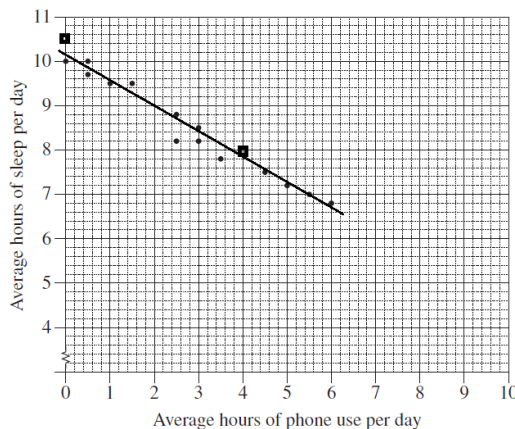


Q21  $0.02 \times 800000 + 0.015 \times (1500000 - 800000) = 26500$  dollars

Q22a  $C = 100 \times 1943 + 20180 = 214480$  dollars

Q22b  $97040 = 100n + 26n + 20180, 126n = 76860, n = 610$

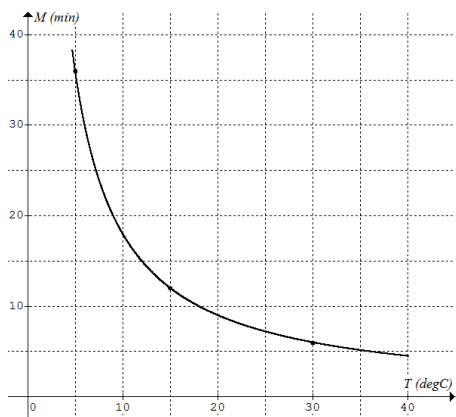
Q23a, b 9 hours of sleep per day on average



Q24a  $M = \frac{k}{T}$  and  $(15, 12), 12 = \frac{k}{15}, k = 180, M = \frac{180}{T}$

Q24b

|   |    |    |    |
|---|----|----|----|
| T | 5  | 15 | 30 |
| M | 36 | 12 | 6  |



Q25a  $\frac{\$15000}{4.184} \approx \$3585.086 \approx \$3585.09$

Q25b Interest =  $\$15000 - 4 \times \$3585.086 \approx \$659.66 \approx \$660$

Q26  $BA = 35 \tan 41^\circ$ ,  $\sin \theta = \frac{BA}{93} = \frac{35 \tan 41^\circ}{93} \approx 0.32715$

$\theta = \sin^{-1} 0.32715 \approx 19.096^\circ \approx 19^\circ 6'$

Q27ai  $1 - 0.80 = 0.20 = 20\%$

Q27aii  $S = 50000 \times 0.80^3 = 25600$  dollars

Q27b  $50000 - 50000 \times 0.122n = 25600$ ,  $n = 4$

Q28  $V = \text{cross-sectional area} \times \text{length}$   
 $= \frac{1}{2} \times 25 \times 25 \times \sin 150^\circ \times 50 = 7812.5 \text{ m}^2$   
 $= 7812.5 \times 1000 = 7812500$  litres

Q29 The time difference between Sydney and New York is 15 hours.  
 8 : 20 pm Wednesday Sydney time is 5 : 20 am Wednesday New York time.  
 The plane lands in New York 20 hours and 24 minutes later.  
 New York landing time, by adding 20 hours and 24 minutes to 5 : 20 am Wednesday, is 1 : 44 am Thursday.

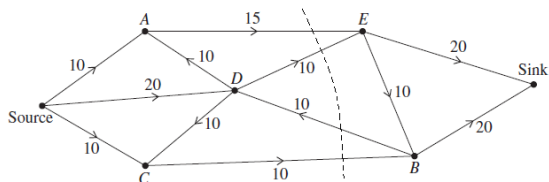
Q30a  $A = 40000 \left(1 + \frac{1.2\%}{12}\right)^{10 \times 12} = 40000 \times 1.001^{120} \approx 45097.17$  dollars

Q30b  $\text{Rate} = \frac{2.4\%}{4} = 0.006$ ,  $N = 10 \times 4 = 40$

Use table:  $A = 45.05630 \times 1000 = 45056.30$   
 Difference  $\approx 45056.30 - 45097.17 \approx -40.87$   
 Future value using Option 2 is \$40.87 less than using Option 1.

Q31a  $10 + 20 + 10 = 40$

Q31b Maximum flow = minimum cut =  $35 < 40$



Q31c The flows in  $AE$  and  $CB$  are restricted by the flows in their predecessors. Increase  $DE$  by 5.

Q32a Area  $\approx \frac{1}{2}(160 + 150) \times 100 + \frac{1}{2}(150 + 250) \times 100 = 35500 \text{ m}^2$

Q32b Area  $\approx 250 \times 200 + \frac{1}{2} \pi \times 100^2 - 35500 \approx 30208 \text{ cm}^2$

Q33a  $\angle AOB = 180^\circ - 135^\circ = 45^\circ$   
 $AB = \sqrt{50^2 + 20^2 - 2 \times 50 \times 20 \cos 45^\circ} \approx 38.5 \text{ km}$

Q33b  $\frac{\sin \angle OBA}{20} = \frac{\sin 45^\circ}{38.5}$ ,  $\angle OBA \approx 22^\circ$

Q33c  $180^\circ + 22^\circ = 202^\circ \text{ T}$

Q34 The top surface area of the cylinder will make up for the covered area on the flat surface of the hemisphere.

Total surface area =  $\frac{1}{2} \times (4\pi \times 3^2) + \pi \times 3^2 + \pi \times 4 \times 3 \approx 122.5 \text{ cm}^2$

Q35 The scatterplot shows that in general as the age of character is higher, the age of actor is also higher.  
 The line of best fit indicates that there is a linear relationship between the age of character and the age of actor.  
 The equation  $y = -7.51 + 1.85x$  shows that on average for each year of increase in the age of character, there is an increase of 1.85 years in the age of actor.  
 Coefficient 0.4564 indicates that there is a moderate correlation between the age of character and the age of actor.

Q36a  $A = \$199715 \times \frac{0.072}{12} = \$1198.29$   
 $B = \$199428.29 + \$1196.57 - \$1485 = \$199139.86$

Q36b Follow the original repayment plan:  
 Total of  $23 \times 12 = 276$  repayments amounts to  $\$1485 \times 276 = \$409860$   
 Following the changed plan:  
 Total amount repaid =  $\$1485 \times 50 + \$40000 + \$1485 \times 146 = \$331060$   
 Saving (how much less) =  $\$409860 - \$331060 = \$78800$

Q37  $\Pr(840 < X < 860) = 0.6 - 0.5 = 0.1 \therefore \Pr(820 < X < 840) = 0.1$   
 920 is one standard deviation from the mean,  
 $\therefore \Pr(840 < X < 920) = \frac{0.68}{2} = 0.34$   
 $\therefore \Pr(820 < X < 920) = 0.1 + 0.34 = 0.44$ , i.e. 44%

Q38 3.6 L left after removing 1.2 L of solution.  
 Ratio of cordial : water remains 1 : 3  
 $\therefore 0.9 \text{ L of cordial} : 2.7 \text{ L of water}$   
 After adding 1.2 L of water,  
 the ratio is 0.9 L of cordial : 3.9 L of water, or 3 : 13

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