2020 NSW ESA Mathematics Standard 2 Solutions

Section I

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

Q1 C

Q2 D

Q3 $\frac{75}{50}=1.5\text{ hours}=1\text{ hour }30\text{ minutes}$ C

Q4 $200\left(1+\frac{3}{100\times12}\right)^{18}\approx209.19$ B

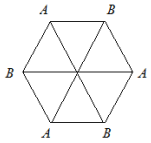
Q5 $\frac{0.05}{16.0}\times100\%=0.3125\%$ A

Q6 $2\times5=10$ D

Q7 A

Q8 French $z=1.5$; Commerce $z=3$; Music $z=2$ A

Q9 B



Q10 D

Q11 $10000\left(1-\frac{8}{100}\right)^{10}\approx4343.88$ C

Q12 D

Q13 $\text{Number of hours}=\frac{0.08375-0.05}{0.015}=2.25$

$10:30\text{ pm}+2\text{ hours }15\text{ min}=12:45\text{ am}$ A

Q14 The present value is smaller than $10\times\$1000$ because interest is still to be applied to it. A

Q15 Four ways to score 6: 1×6, 6×1, 2×3, 3×2

$P(6)=\frac{4}{6\times8}=\frac{1}{12}$ B

Section II

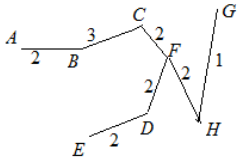
Q16a $\tan\theta=\frac{8}{10}$, $\theta\approx39°$

Q16b $x=\sqrt{8^2+10^2}\approx12.8$

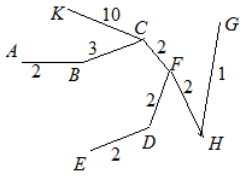
Q17 $\text{Number of sections}=\frac{1000\times1000}{5\times5}=40000$

$\text{Number of trees}\approx40000\times8=320000$

Q18a Minimum length $=2+3+2+2+1+2+2=14$



Q18b Minimum length $=2+3+2+2+1+2+2+10=24$



Q19a Read from graph, 200 metres

Q19b Maximum area when $x=\frac{300}{2}=150$ m

$y=\frac{900-3\times150}{2}=225\text{ m}$

Q19c Maximum area $=xy=150\times225=33750\text{ m}^2$

Q20 $3000\times12-(20797+0.37(122680-90000))=3111.40$ dollars

Q21 $2019\text{ cost}=\frac{122}{1+0.02}\approx119.61\text{ dollars}$

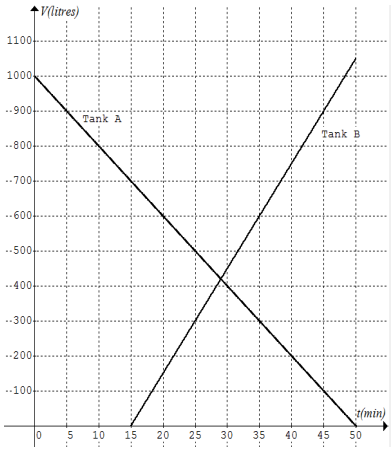
Q22 $500\left(1+\frac{17}{100\times365}\right)^{15}-250\approx253.50\text{ dollars}$

Q23a $p:m:o=15:9:4$, $\frac{o}{3}=\frac{4}{15}$, $o=0.8\text{ litres}$

Q23b $V=40\times20\times35=28000\text{ cm}^3=28\text{ litres}$

$m:total=9:(15+9+4)=9:28$, $m=9\text{ litres}$

Q24a



Q24b Tank A: $V=1000-20t$; Tnak B: $V=30(t-15)$

Same volume: $30(t-15)=1000-20t$, $50t=1450$, $t=29$

Q24c $30(t-15)+1000-20t=1000$, $t>0$ $\therefore$ $10t=450$, $t=45$

Q25 $\text{S.A.} = 8(5+5+8+8+8)+2\left(8^2+\frac{1}{2}\times 8(11-8)\right) = 424\text{ cm}^2$

Q26a Minimum time $= 8+12+6+10+8+2 = 46\text{ min}$

Q26b *CDEFHI*

Q26c

Activity	*Earliest start time*	*Float time*
A	0	12
G	20	15

Q27a $\text{Area} \approx \frac{1}{2}\times 20(25+2\times 20+20) = 850\text{ m}^2$

Q27b The approximate area is more than the actual area because both 'parabolic curves' are concave upwards.

Q28 $\frac{1+5+9+10+15}{5} = 8$ is the mean of the first dataset.

$\frac{5\times 8+x}{6}-8 = 10\left(\frac{9+10}{2}-9\right)$, $x = 38$

Q29 $200\times 6\%\times 5.50 + n\times 4\%\times 6.00 = 149.52$, $n = 348$

Q30a Maximum flow $= 50+75+100+50 = 275$

Q30b Maximum flow = minimum cut capacity = 275.
The added cut has a capacity of 325 .: it is not a minimum cut.

Q31a $100°-35° = 65°$

Q31b $AB = \sqrt{7^2+9^2-2(7)(9)\cos 65°} \approx 8.76\text{ km}$

Q31c $\frac{\sin\angle BAP}{9} = \frac{\sin 65°}{8.76}$, $\angle BAP \approx 68.6°$

Bearing $\approx 180°-(68.6°-35°) \approx 146°$

Q32 $AB = 8$, $\angle AOB = 36°$, $\angle OAB = \angle OBA = 72°$

$\frac{OA}{\sin 72°} = \frac{8}{\sin 36°}$, $OA \approx 12.9443$,

area $\Delta OAB = \frac{1}{2}\times 8\times 12.9443\times \sin 72° \approx 49.243$

.: required area $\approx 492.4\text{ cm}^2$

Q33a $y = 4000$

Q33b $y = A\times b^n$, $1000 = A$, $4000 = A\times b^{40}$, $b^{40} = 4$

$1 < b < 2$, $1.1^{40} \approx 45$, $1.01^{40} \approx 1.49$, $1.02^{40} \approx 2.2$, $1.03^{40} \approx 3.26$

$1.04^{40} \approx 4.8$

The lower and upper estimates of b are 1.03 and 1.04 respectively.

Q34a $A_1 = 60000(1.005)-800 = 59500$,

$A_2 = 59500(1.005)-800 = 58997.50$,

$A_3 = 58997.50(1.005)-800 \approx 58492.49$ dollars

Q34b $I = (60000+59500+58997.50)\times 0.005 \approx 892.49$ dollars

Q35a A: $P(IQ > 128) = P(Z > 2) \approx \frac{1-0.95}{2}\times 100\% = 2.5\%$

Q35b B: $P(IQ < 128) = P(Z < 1) \approx 0.5+\frac{0.68}{2} = 0.84$

Expected number $\approx 0.84\times 1000000 = 840000$

Q35c A: $\mu = 108$, $\sigma = 10$ B: $\mu = 112$, $\sigma = 16$

$z = \frac{IQ-108}{10} = \frac{IQ-112}{16}$, $IQ \approx 101.3$

Q36 $\bar{x} = 22-0.525 = 21.475$, $\bar{y} = \frac{684}{20} = 34.2$

$b = \frac{y+10.6063}{x} = \frac{\bar{y}+10.6063}{\bar{x}}$.: $\frac{y+10.6063}{19} = \frac{34.2+10.6063}{21.475}$

.: $y \approx 29$

Q37 For the first 20 years she needs $PV = \$1000\times 16.351 = \$16352$.
For the next 10 years she needs $PV = \$3000\times 8.983 = \$26949$ at the start of the 21st year.
At the start, i.e. 20 years earlier, \$26949 is considered as the future value FV.

.: the present value PV (i.e. value at the start) $= \frac{26949}{1.02^{20}} \approx \$18135.90$

.: minimum opening lump sum $= \$16352+\$18135.90 = \$34486.90$

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