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**MATHEMATICS**

**METHODS**

**UNITS 3 & 4**

**Semester Two**

**2019**

**SOLUTIONS**

***Calculator−free Solutions***

1. (a)  ✓

  ✓

 (b)  ✓

  ✓ [4]

2. (a)  (where therefore  ) ✓

 

  ✓

 Stationary point at (  , ln 2 ) ✓

 (b)  ✓

  |  ✓

 = therefore maximum turning point. ✓ [6]

3.  ✓

  ✓

  ✓ [3]

4. (a) (i) **

 Let ln *x =m*

  ✓

  ✓

  ✓

 (ii)  ✓

 36 = 3*x*

 ** ✓

 (b)  ✓

  therefore  at ,) ✓

 

  ✓ [8]

5. (a)  ✓✓

 (b) (i) False ✓

 In a very large number of samples, 95% of those confidence intervals

 would contain *p.* The endpoints of the confidence interval refer to the

 confidence and not the probability. *p* is not a random variable and is

 either in the CI or not. ✓

 (ii) False ✓

 The confidence interval is about the population proportion and not

 about the individual Australian households ✓

 (iii) True ✓

 (iv) True ✓ [8]

 (the centre of the interval contains the sample proportion)

6. (a) 

  ✓✓

 (b) 

  ✓

  ✓

 

 Max velocity is 6m/s ✓

 (c)  ✓

 = + ✓

  ✓

 = m. ✓ [9]

7. (a) 

  ✓

  ✓

 

  ✓

 (b)  ✓

  ✓

 =  ✓ [6]

8. (a)  ✓

  ✓

 (b)  ✓

  ✓ [4]

9. 

 

 

  ✓

  ✓

  ✓

  units2  ✓ [4]

***Calculator−assumed Solutions***

10. (a) and✓  ✓

 0.26 of 500 = 130. ✓

 (b) *z =* 1.641 Therefore 90 % confidence level. ✓✓ [5]

11. (a) (i) *n* = 20 p = 0.63

 P (X ≥ 14) = 0.3453 ✓

 (ii) P (X = 20 | X 14) =  ✓✓

 (b) P(X1) 0.95

 

  ✓

  ✓

 *n* = 3.01

 4 people would need to be selected ✓

 (c) E(X)= np

 = 300 x 0.63

 = 189 ✓

  ✓

 (d)  ✓

 *n* = 253 credit card holders ✓ [10]

12.  ✓✓

 = 25.81693

 The profit earned on sales between 500 and 1000 litres is $25.82. ✓ [3]

13. (a) (i)  ✓

 (ii)  ✓

 = 0.1055 + 0.079101 + 0.059326

 = 0.243927 ✓

 (b) (i) Discrete, independent probability ✓

 two outcomes: Success or fail ✓

 (ii) E(X) = 0.25 ✓

 Standard deviation = = 0.43301 ✓ [7]

14. (a)  = 8900 litres ✓

 (b) Variance = 

 = 496 666.67 ✓

 Standard deviation = 704.75 705 litres ✓

 (c) P (X ≤ 8550 | 7000 < X < 10 000) =  ✓✓

 (d)  ✓

 *x =* 7067 litres

Garage must sell 7068 litres to be profitable ✓ [7]

15. Underestimate: 1 x (0 + 10 + 15 + 11 + 4) = 40 ✓

 Over estimate: 1 x (10 + 15 + 16 + 16 + 11) = 68 ✓

 Average = 54

 Distance is therefore approximately 54 m. ✓ [3]

16. (a) Self-selective sample and therefore not representative of the population. ✓

 Only radio listeners were part of the survey, therefore not representative. ✓

 (b) Logical answer for example:

 a randomly selected sample from the general public is used ✓

 (c) 0.03 ✓

 (d) Therefore point estimate = 0.15 or ✓

 (e)

  ✓

  ✓

 

 85.4% confidence level ✓ [8]

17. (a) At time *t*, the distance from *B* to *S* is. ✓

 At time *t*, the distance from *A* to *S* is 80*t.* ✓

 Cosine rule ✓

 Therefore 

 (b) ✓

  ✓

  ✓

 minimum ✓

 The minimum distance is 61 km. [7]

18. (a)  and 0 otherwise ✓

 (b) 32.5 min ✓

 (c)  ✓

 (d) (i)  ✓

 (ii)  ✓

 (e) E(X) = 32.5 Var(X)= 18.75 ✓

  ✓

  ✓

  ✓ [9]

19. (a)  for t > 0 ✓✓

 (b) F(20) = 0.6321 ✓

 (c) 

  ✓✓

 or

 

 (d) E(*t*) = 

 20 months is the mean time (or *k* = 20 = μ) ✓

 (e) 

 ∴ *q* = 2.02 therefore just over 2 months ✓ [7]

20. (a)  ✓

 *x* = 3.0539 ✓

 (b)  ✓

 =1.2416 ✓

 (c) 

 *P*(3) − *P*(1) = 0.93119 – 0.011496 = 0.9197

 or  ✓✓

 (d)  ✓

 

  ✓✓ [9]

21. (a) 0.02275 x 3000 = 68.25 ∴ 68 people ✓

 (b) (i) $75 538.04 ✓

 (ii) B ~ (3, 0.08) ∴ P(X = 1) = 0.2031 ✓✓

 (c) New mean = $66 875 ✓

 Standard deviation = $7687.50 ✓

 (d)  ✓

 Therefore 4 interns ✓ [8]

22. (a) 384 carp ✓

 (b) 

 *t* = 148.8 months ✓

 In the 149th month

 (c)  ✓

  ✓

 *t* = 136.2 months after the intro of bass (the 137th month) ✓ [5]

23. (a) Therefore the distribution cannot be determined. ✓

 (b) (i) Normal distribution ✓

 N(0.06, 0.013711) ✓✓

 (ii) 0.9999 ✓ [5]

24. (a)  ✓✓

 (b) (i) Whisper: I = 1013 W/m2

 Conversation: I = 1018 W/m2 ✓

 The intensity of the conversation is 105 times ✓

 more than the whisper.

 (ii) The loudness is an additional 3.0103 dB (10log 2) ✓ [5]