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**SEMESTER TWO**

**MATHEMATICS**

**METHODS**

**UNITS 3 & 4**

**2021**

**SOLUTIONS**

**Calculator−free Solutions**

1. (a) 

  ✓

 When x = 2π, *m* ✓

 

  ✓

 (b)  ✓✓ [5]

2. (a) 

 *k* = 15 ✓

 (b)  ✓

 (c)  ✓

 (d) (i) Expected value  ✓

 Variance of *Y*: 

 Standard deviation of *Y* =  ✓

 Standard deviation of *X* =  ✓

 (ii)  ✓✓ [8]

3. (a)  whenis concave down ✓✓

 (b) Maximum ✓

 (c)

 Correct point of inflection ✓

 Shape showing local minimum and maximum ✓ [5]

4. (a) 

  ✓

  ✓

 

 

  ✓

 (b)  ✓

 = 3 ✓

 (c)  ✓

 

 

  ✓ [7]

5. (a) 0.16 ✓

 (b) 0.34 ✓

 (c)  ✓✓ [4]

6. 

  ✓

 

  ✓

  ✓ [3]

7.  ✓

 

  ✓

 ∴  ✓

 ∴  ✓ [4]

8. (a)  ✓

 (b)  ✓✓

 (c) 10 minutes ✓ [4]

9.  ✓

  ✓

 

  ✓ [3]

10. (a)  ✓✓

 (b)  ✓

 *p* = 2 ✓

(c) (i)

 ✓

10. (c) (ii) 

  ✓✓ [7]

**Calculator−Assumed Solutions**

11. (a)  ✓

 Maximum profit occurs when 

 therefore *t* = 8.57 years ✓

 (b)  ✓

 Maximum profit = $25714285-$12000000 = $13 714 285 ✓ [4]

12. (a) Discrete data; Independent events ✓

 Only two outcomes: under the limit or over the limit. ✓

 (b) (i) **** ✓

 ✓

 (0.01048)+(0.07463)(0.11556)+(0.31512)(0.00685)+(0.00024)

 = 0.02150 ✓

 (ii)  ✓

 (iii) X~Bin(275, 0.05) E (X) = 13.75

 ∴ 13 drivers. ✓

 Variance = 275 x 0.05 x 0.95 = 13.0625

 Standard deviation = 3.6142 ✓

 (iv) 

  ✓

 

  ✓

 Therefore the maximum value of *n* = 70 ✓ [11]

13. Point of intersection:

 

 

Area of shaded part:

  units2 ✓✓ Alternate

 Shaded area under line:

  units2  ✓

 Fraction:  ✓ [4]

14. (a) AC = *t* – 30  ✓

  ✓

 Volume of cone = 

  ✓

 (b)  ✓

 *t* = 0 or 40 ✓

 

  ✓

 (c) Volume of cone at *t* = 40 cm is  ✓

 Volume of sphere = 113 097.336 cm3

 Percentage = 29.63% ✓

 (d)   

  ✓

 

  ✓

 Approximately 4.5% decrease in volume. ✓ [11]

15. (a)  ✓

 (b) Less than 5 minutes:  ✓

 Percentage 5 minutes or longer = 31.5% ✓

 (c) (i) *t* is a continuous random variable where

 The function in the domain is positive.

 The probability at *t* = 0 is 0 and *t* = 30 is 1,

 therefore is cumulative. ✓✓

 (ii)  ✓

 (iii)  ✓✓ [8]

16. 

  ✓

  ✓

  ✓

 The liquid was placed in the fridge at 11:37 am ✓ [4]

17. (a) 6 year old tree is growing at a rate of 17.69 cm/year

 50 year old tree is growing at a rate of 2.277 cm/year ✓

 7.8 times faster ✓

 (b) (i) Convenience sample: this sample may not be

 representative of all the six year old trees in the plantation.

 The sample is not large enough. ✓✓

 (ii) Stratified sample where a number of trees from each

 area according to the size of the area are chosen at random.

 Or

 Systematic and Array sample: Every *n*th tree starting

 at a randomly assigned tree as one walks down each row.✓✓

 (c) (i)  ✓

  ✓

 cm ✓

 (ii) According to the model, the height of a six year old tree

 is 297.8 cm and the mean of the sample is the same,

 therefore the model is suitable. ✓

 (iii)  ✓

 (d)  ✓✓

 With a 99% confidence level, between 26.9% and 39.1% of the

 mature trees can be used for luxury furniture. ✓ [14]

18. Over - estimate = 0.2(0.127+0.172+0.184+0.184+0.181) = 0.1696 ✓

 Under - estimate = 0.2(0+0.127+0.172+0.181+0.173) = 0.1306 ✓

 Average = 0.1501 units2 ✓ [3]

19. (a) (i) *n* > 30

 *np* = 300 x 0.12 = 36 *npq* = 300 x 0.12 x 0.88 = 31.68

 *np* > 10 *npq* > 10 therefore

 a normal distribution can apply. ✓✓

 (ii)  ✓✓

 (iii)  ✓

 (iv)  ✓

 10.7% ✓

 (b) (i)  ✓

 (ii) Expected waiting time= 12.5 days ✓

 Normal distribution  ✓✓

 (iii)  ✓ [12]

20. (a)  ✓

  ✓✓

 = 

 (b) (i) 

 Hydronium ions range from

  moles per litre ✓

 to

 moles per litre ✓

 (ii)  ✓

 *pH* = 7.32 therefore it is not acidic. ✓ [7]

21. (a)  ✓

 (b) (i) (0.2455, 0.4545) ✓✓

 (ii) ME= ✓

 (iii) 95% the width is 0.209

 99% the width is 0.2747 ✓

 0.209*x* = 0.2747

 *x* = 1.3144 ✓

 Therefore an increase of 31.45%

 (c)  ✓

 *n* = 2184.9 ✓

 Therefore sample size of 2185 ✓

 (d) 0.95 x 40 = 38

 ∴ Approximately 38 would contain the true proportion ✓ [10]

22. (a) 

  ✓

 

  therefore c = 0 ✓

 units/sec ✓

 (b) units/sec ✓

  units/sec2 ✓

 The velocity and the acceleration are both negative,

 therefore the particle is moving faster to the left.

 ∴ Increasing speed ✓

 (c) 

  ✓

 units ✓

 (d)  ✓✓

 (e)  ✓✓ [12]

End of Questions