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**SEMESTER ONE**

**MATHEMATICS**

**METHODS**

**UNIT 3**

**2020**

**SOLUTIONS**

**Calculator−free Solutions**

1. (a)  ✓✓

 (b)  ✓✓

 (c) 

 ∴  ✓✓✓ [7]

2. (a)  ✓

  ✓

  ✓

  ✓

 ∴ 

 (b) 0 ✓

 (c)  ✓ [6]

3. (a)  ✓✓

 (b) 

 ∴  ✓✓

 ∴  ✓

 ∴  ✓

 (c)  ✓

 ∴  ✓✓ [9]

4. (a) 6 represents  ✓

 ∴  ✓

 ∴  ✓

 and  ✓

 (b) E(X) =  ✓

 ∴ E(X) =  ✓ [6]

5. (a) (i)  ✓✓

 (ii)  ✓✓

 (b)  ✓

 ∴  ✓

 ∴ 

 ∴  ✓

 ∴  ✓ [8]

6. (a) (i) 

 ∴  ✓

 (ii) 

 =  ✓✓

 (iii)  ✓✓

 (b) We would need to know where *h*(*t*) lies below the x−axis. ✓ [6]

7. (0, 2) → e = 2 ✓

  ✓

 ∴  ✓

  ✓

 ∴  ✓

 and  ✓

  ✓

 Hence  ✓ [8]

**Calculator−Assumed Solutions**

8. (a) *a* + *b* = 26 ✓

  ✓

 ∴ ***a*** = 16 and ***b*** = 10 ✓✓

 (b) Standard deviation = 6.44 ✓✓

 (c) (i)  ✓

 (ii)  ✓ ✓ [9]

9. (a)

 ✓✓✓✓

 (b) (i)  ✓✓

 (ii)  ✓✓

 (c)  ✓

 = 

 = 4 ✓ [10]

10. (a)   ✓

 ∴  ✓

 ∴  ✓

 (b)  ✓

 = 3 906 325 = 3 906 500 ✓

 (c)  ✓

 ∴  ✓

 (d)  ✓

 ∴ *t* = 13.39 min ✓

 ∴ 12:58 pm ✓ [10]

11. (a) (i)  ✓

  ✓

 ∴  ✓

 ∴ Min occurs when L′(*x*) = 0 ✓

 ∴ 

 (ii)  ✓

 (b)  ✓

  ✓

 ∴  ✓

 ∴  ✓

 ∴ When  ,  ✓ [10]

12. (a) (i) *x* < −2 or 1 < *x* < 2 ✓✓

 (ii) *x* = −2, 1, 2 ✓✓

 (iii) *x* < −1.4 or *x* > 1.6 ✓✓

 (b) *x* = −1.4 or *x* = 1.6 ✓✓ [8]

13. (a)  ✓

 (b)  ✓

 ✓

 ∴ At midday ✓

 (c)  ✓✓

 (d) ** ✓

 ∴ 1:02 am ✓ [8]

14. (a) DRV and involves success or failure ✓

 (b) (i)  ✓✓

 (ii)  ✓✓

 (iii) 

 ∴ P(X ≥ 2) = 0.9460 ✓✓

 (iv)  ✓✓

 (c) 1 − P(0) = 0.99757

 ∴ P(0) = 0.00243

 ∴  ✓

 ∴ *h* = 0.7 ✓

 (d) VAR = 0.65 x 0.35 = 0.2275 ✓

 ∴ St dev = 0.4770 ✓ [13]

15. (a)  ✓

 TP occurs when *f* ′(*x*) = 0

 ∴  ✓

 ∴  ✓✓

 and height = 2.767 m ✓

 (b) Max gradient occurs when *f* ′′(*x*) = 0

 ∴  ✓

 ∴  ✓

 ∴ Max gradient = 0.93 ✓ [8]

16. (a)  ✓✓

 (b) (i)  ✓

 ∴  ✓

 ∴  ✓

 ∴ 

 (ii)  ✓

 = (0 − 1) − (0 + 1) = −2 ✓

 (c)  ✓ ✓ [9]

17. (a) Uniform ✓

 (b) (i)  ✓

 (ii)  ✓

 (iii)  ✓

 (iv)  ✓

 ∴ Std Dev = ✓

 (c) (i) E(*Y*) = 3 − 2(4) = −5 ✓

 (ii) Std Dev(*Y*) = 2(Std Dev(*X*))

 ∴ =  ✓

 ∴ VAR(Y) =  ✓ [9]

18. (a)  **

 Since 

 ∴ ** ✓✓

 Since x(0) = 0 

 ∴  ✓

 (b)  **  ✓

 

 ∴ Total distance =  ✓✓ [6]