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**SEMESTER ONE**

**MATHEMATICS**

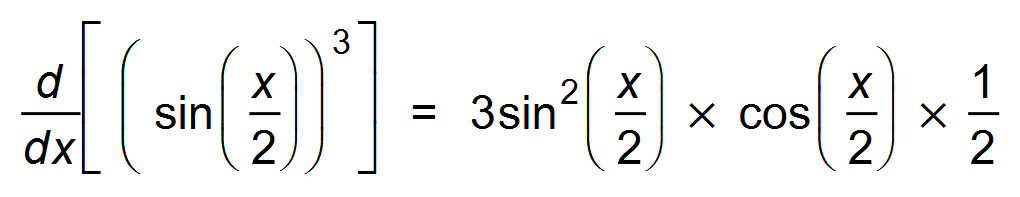
**METHODS**

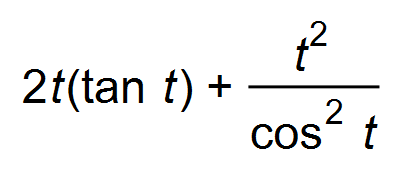
**UNIT 3**

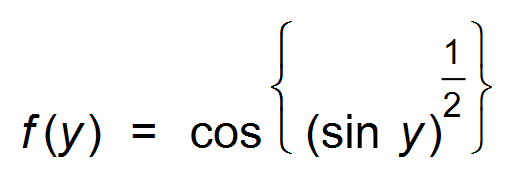
**2020**

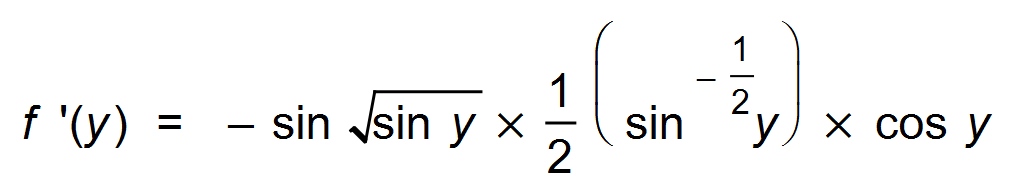
**SOLUTIONS**

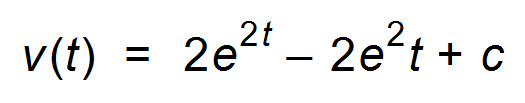
**Calculator−free Solutions**

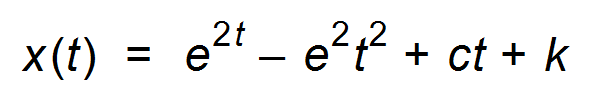
1. (a)  ✓✓

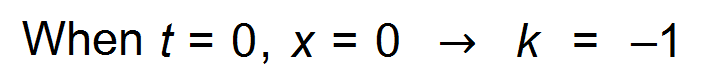
(b)  ✓✓

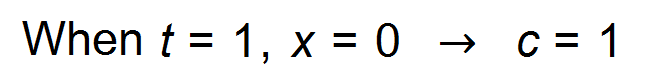
(c) 

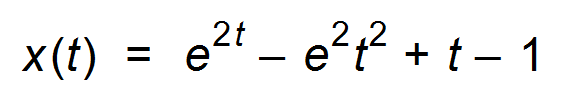
∴  ✓✓✓ [7]

2. (a)  ✓

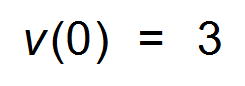
 ✓

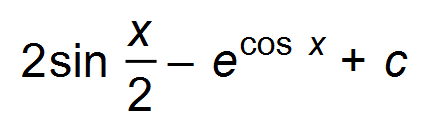
 ✓

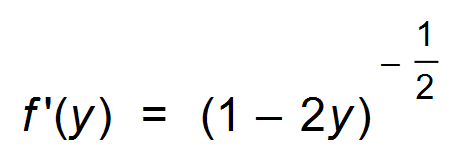
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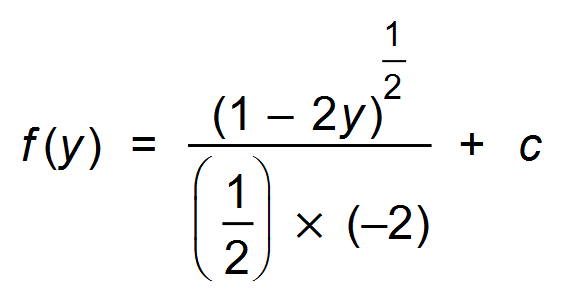
∴ 

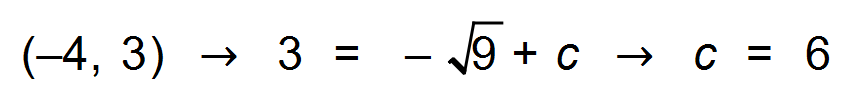
(b) 0 ✓

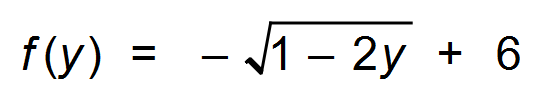
(c)  ✓ [6]

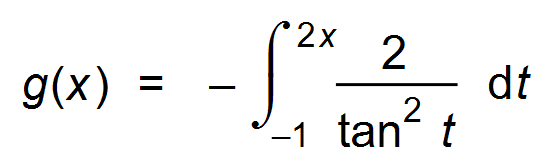
3. (a)  ✓✓

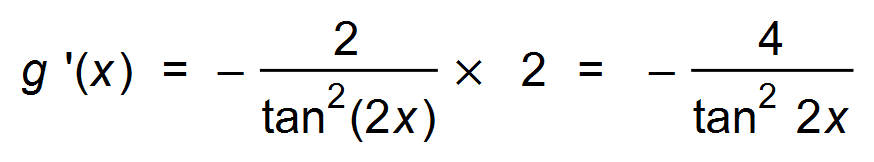
(b) 

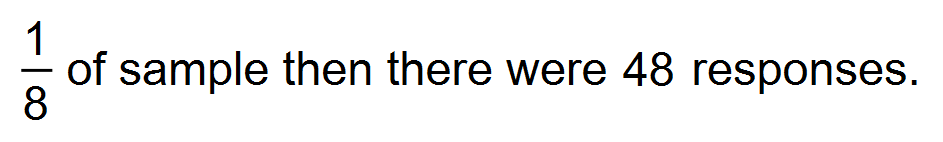
∴  ✓✓

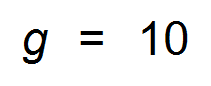
∴  ✓

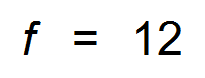
∴  ✓

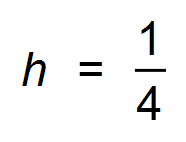
(c)  ✓

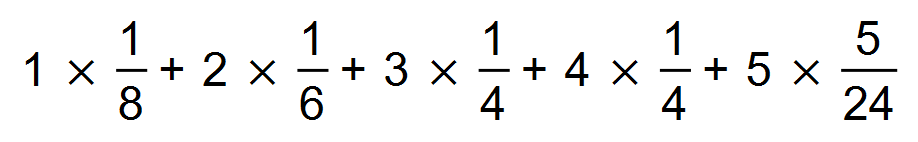
∴  ✓✓ [9]

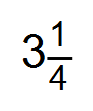
4. (a) 6 represents  ✓

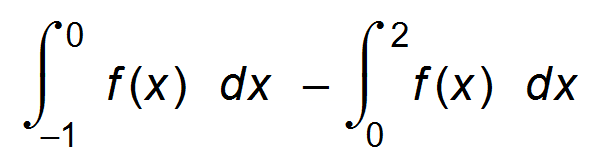
∴  ✓

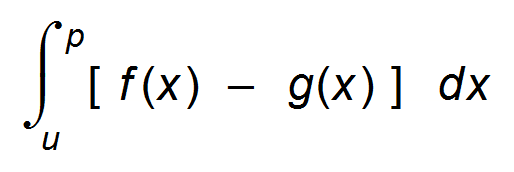
∴  ✓

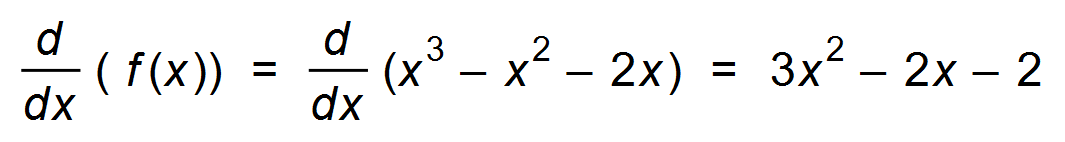
and  ✓

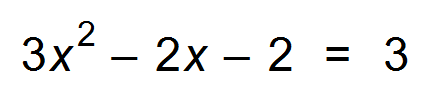
(b) E(X) =  ✓

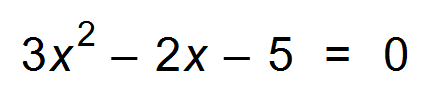
∴ E(X) =  ✓ [6]

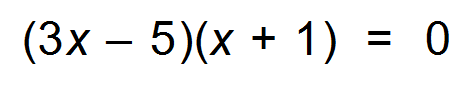
5. (a) (i)  ✓✓

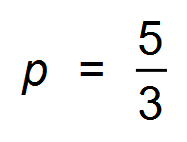
(ii)  ✓✓

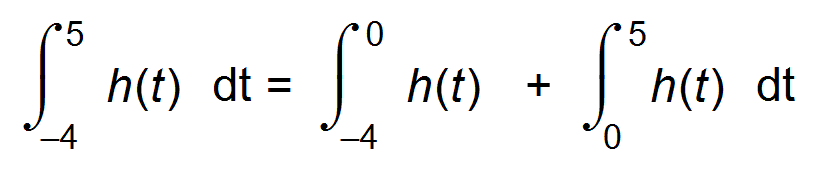
(b)  ✓

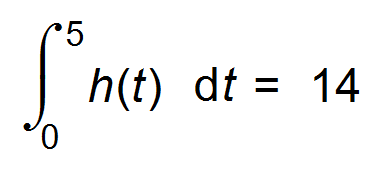
∴  ✓

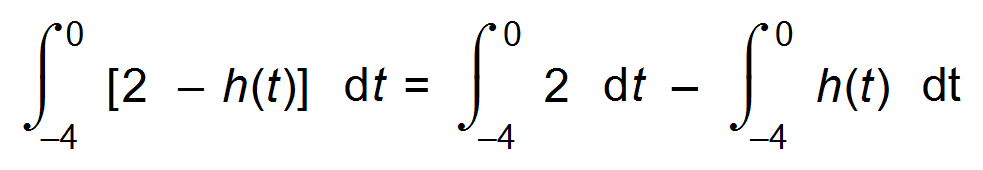
∴ 

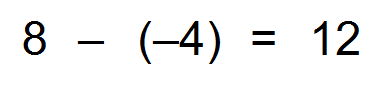
∴  ✓

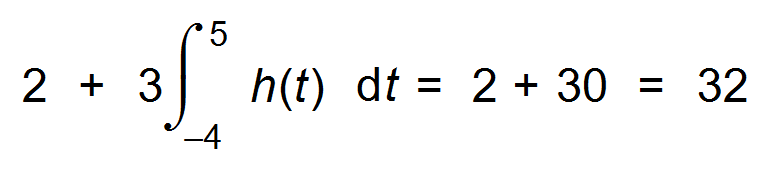
∴  ✓ [8]

6. (a) (i) 

∴  ✓

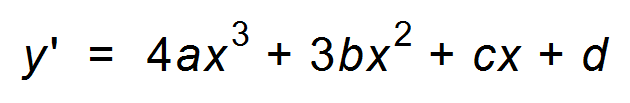
(ii) 

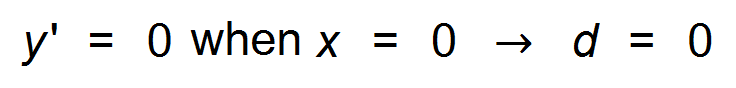
=  ✓✓

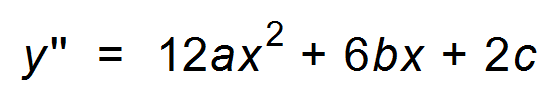
(iii)  ✓✓

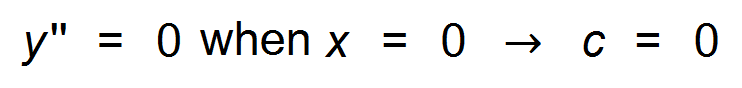
(b) We would need to know where *h*(*t*) lies below the x−axis. ✓ [6]

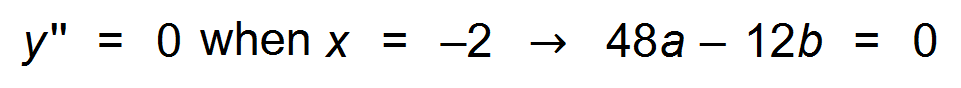
7. (0, 2) → e = 2 ✓

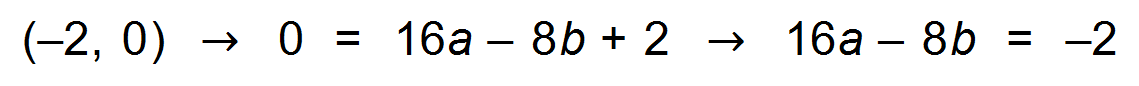
 ✓

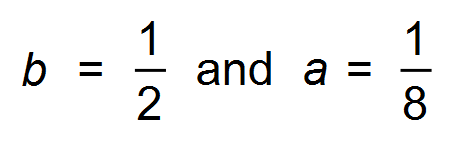
∴  ✓

 ✓

∴  ✓

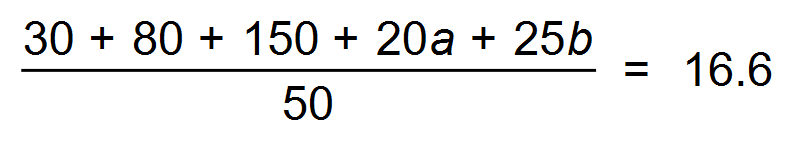
and  ✓

 ✓

Hence  ✓ [8]

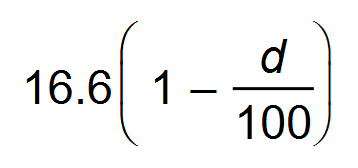
**Calculator−Assumed Solutions**

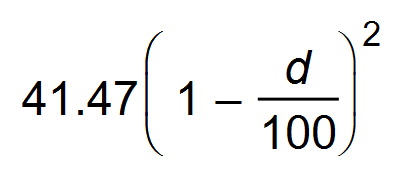
8. (a) *a* + *b* = 26 ✓

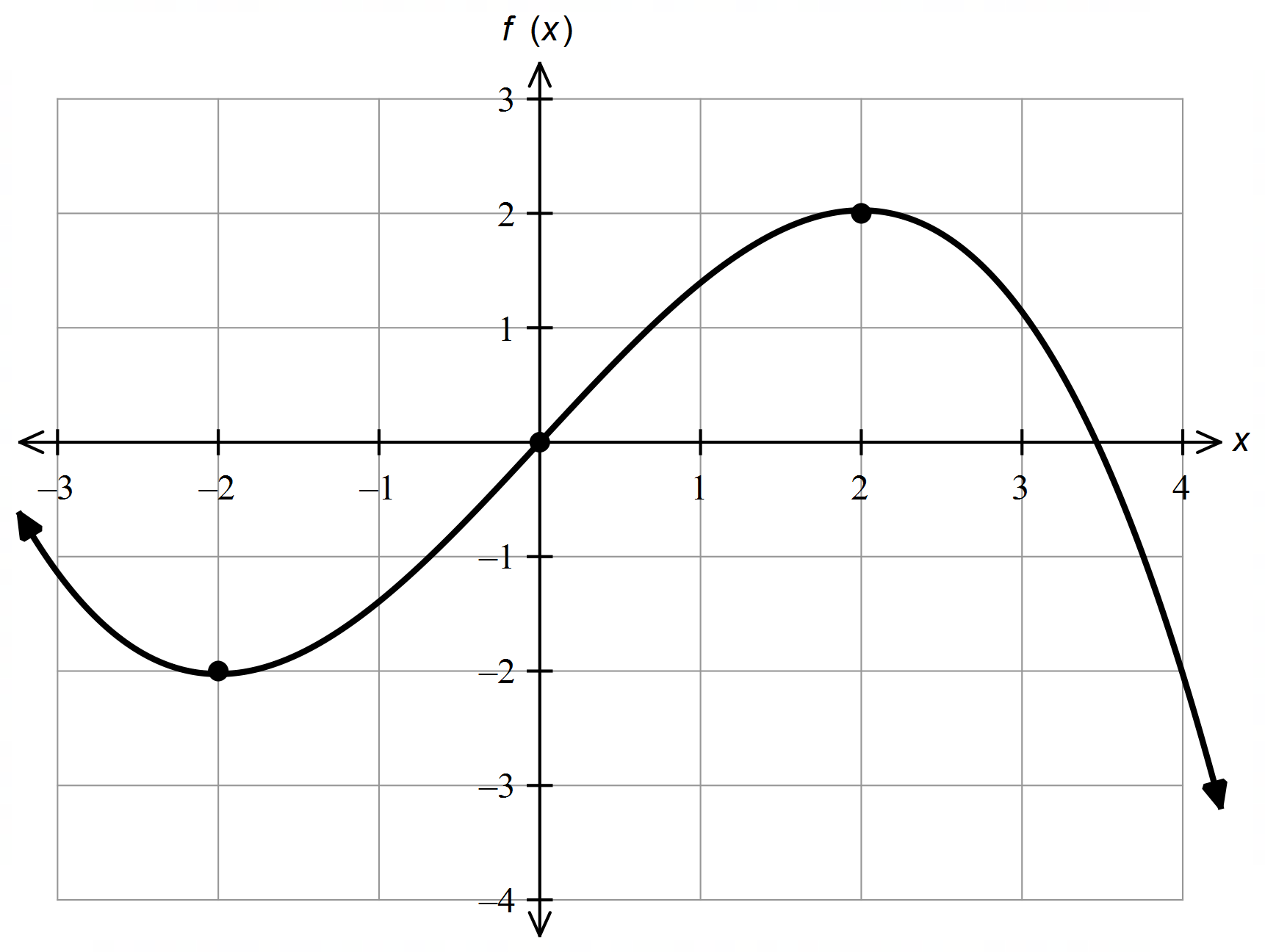
 ✓

∴ ***a*** = 16 and ***b*** = 10 ✓✓

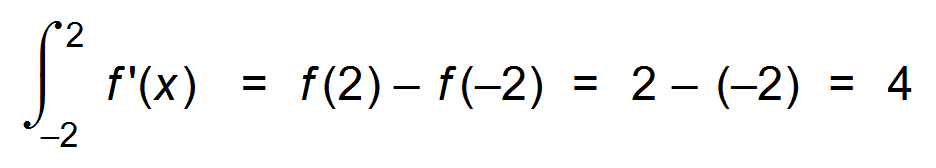
(b) Standard deviation = 6.44 ✓✓

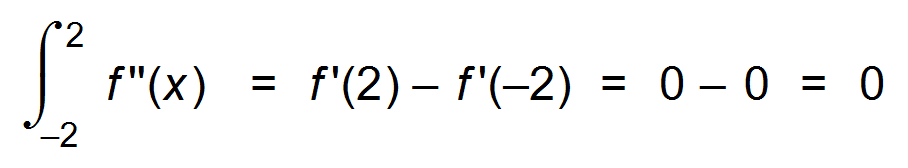
(c) (i)  ✓

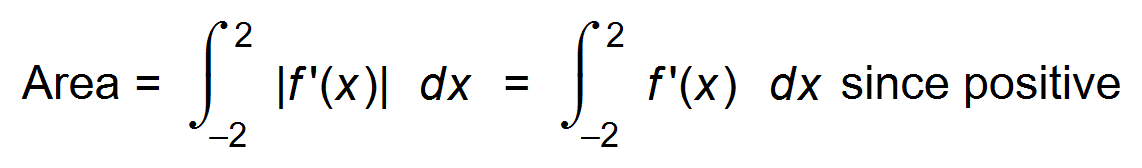
(ii)  ✓ ✓ [9]

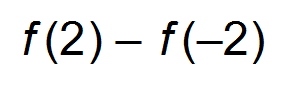
9. (a)

✓✓✓✓

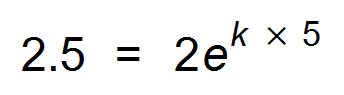
(b) (i)  ✓✓

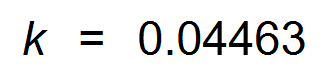
(ii)  ✓✓

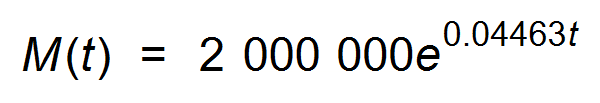
(c)  ✓

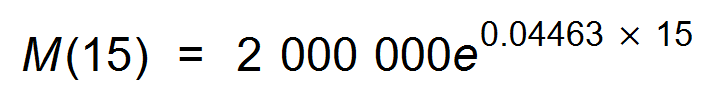
= 

= 4 ✓ [10]

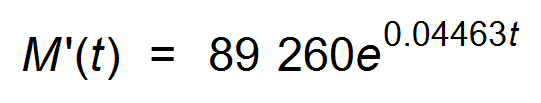
10. (a)   ✓

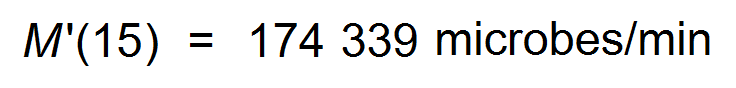
∴  ✓

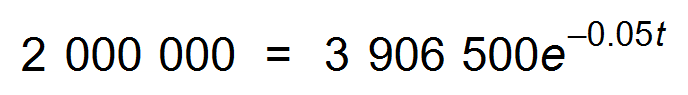
∴  ✓

(b)  ✓

= 3 906 325 = 3 906 500 ✓

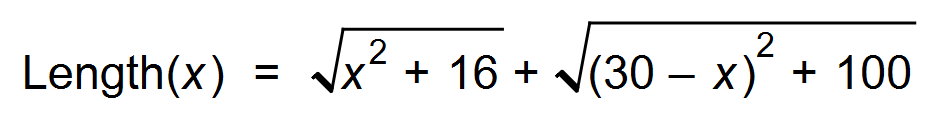
(c)  ✓

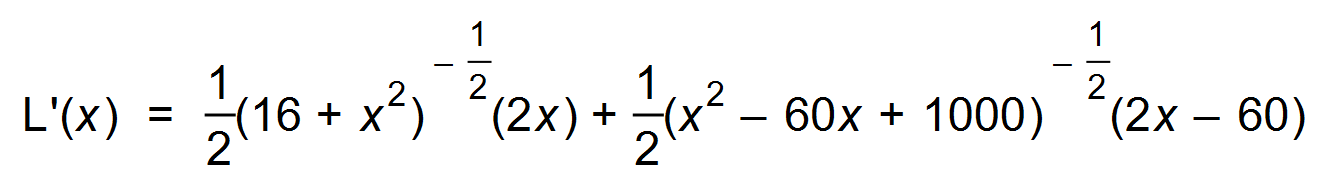
∴  ✓

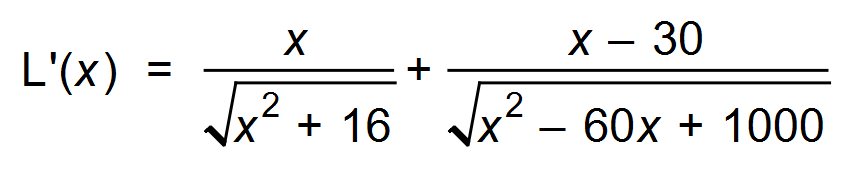
(d)  ✓

∴ *t* = 13.39 min ✓

∴ 12:58 pm ✓ [10]

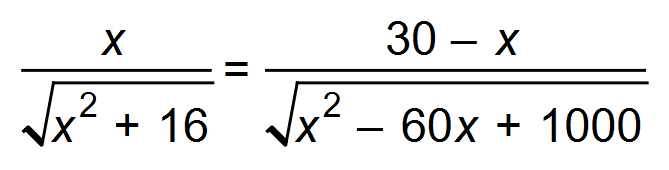
11. (a) (i)  ✓

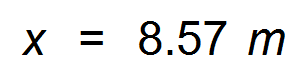
 ✓

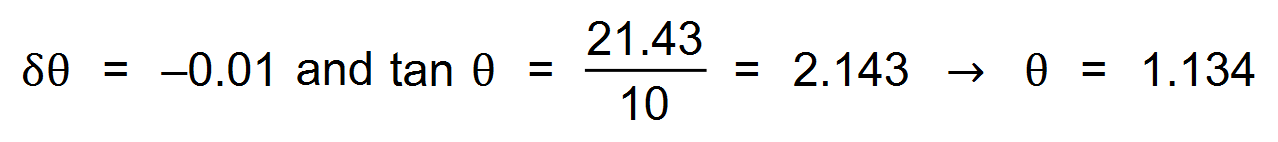
∴  ✓

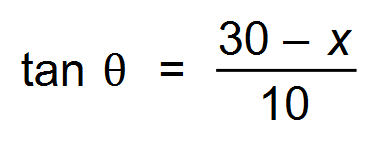


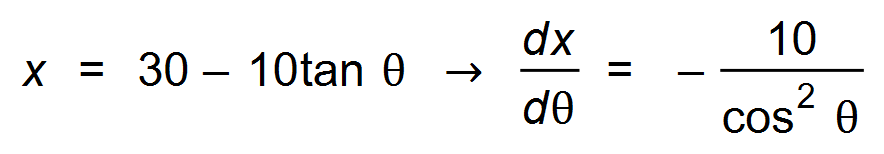
∴ Min occurs when L′(*x*) = 0 ✓

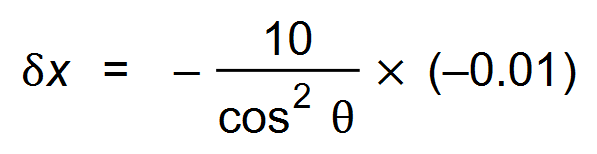
∴ 

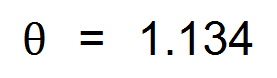
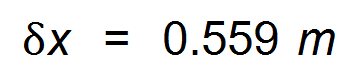
(ii)  ✓

(b)  ✓

 ✓

∴  ✓

∴  ✓

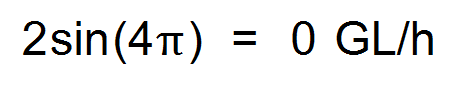
∴ When  ,  ✓ [10]

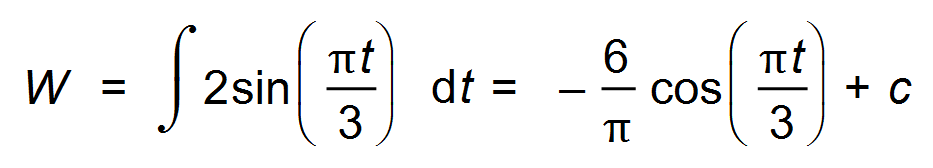
12. (a) (i) *x* < −2 or 1 < *x* < 2 ✓✓

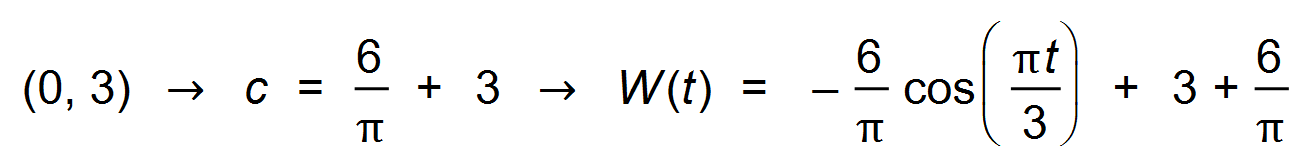
(ii) *x* = −2, 1, 2 ✓✓

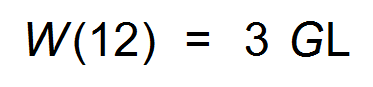
(iii) *x* < −1.4 or *x* > 1.6 ✓✓

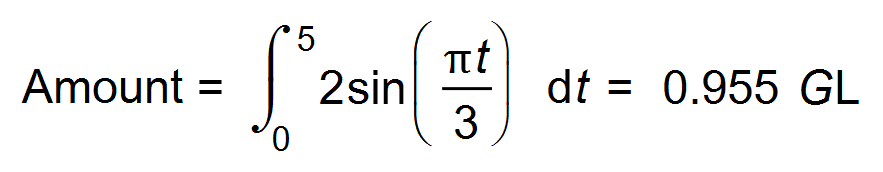
(b) *x* = −1.4 or *x* = 1.6 ✓✓ [8]

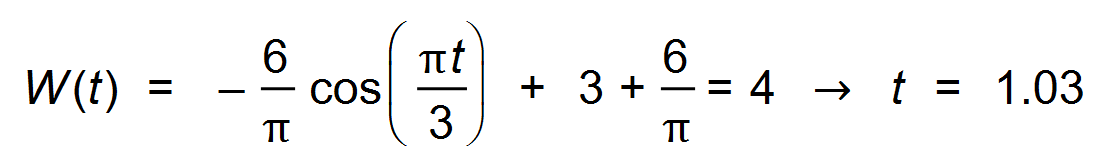
13. (a)  ✓

(b)  ✓

✓

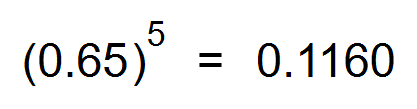
∴ At midday ✓

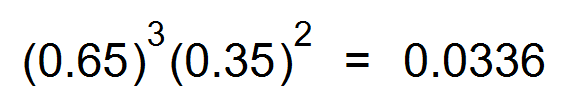
(c)  ✓✓

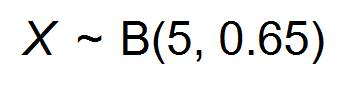
(d) ** ✓

∴ 1:02 am ✓ [8]

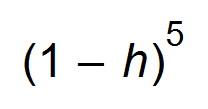
14. (a) DRV and involves success or failure ✓

(b) (i)  ✓✓

(ii)  ✓✓

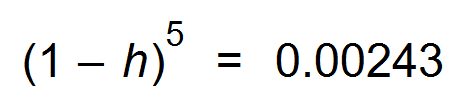
(iii) 

∴ P(X ≥ 2) = 0.9460 ✓✓

(iv)  ✓✓

(c) 1 − P(0) = 0.99757

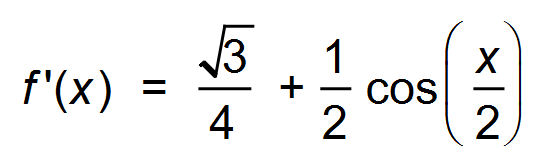
∴ P(0) = 0.00243

∴  ✓

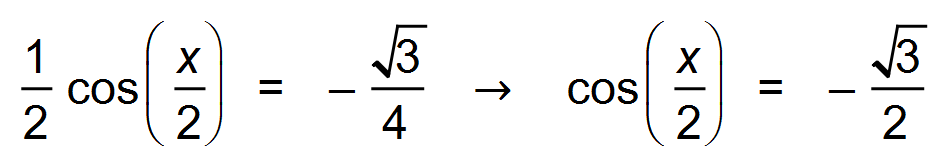
∴ *h* = 0.7 ✓

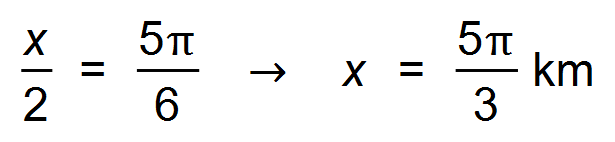
(d) VAR = 0.65 x 0.35 = 0.2275 ✓

∴ St dev = 0.4770 ✓ [13]

15. (a)  ✓

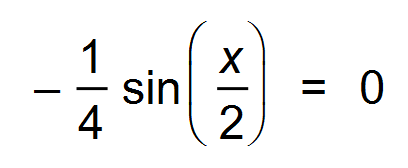
TP occurs when *f* ′(*x*) = 0

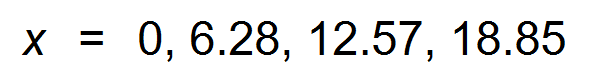
∴  ✓

∴  ✓✓

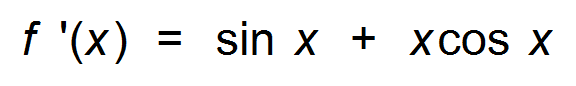
and height = 2.767 m ✓

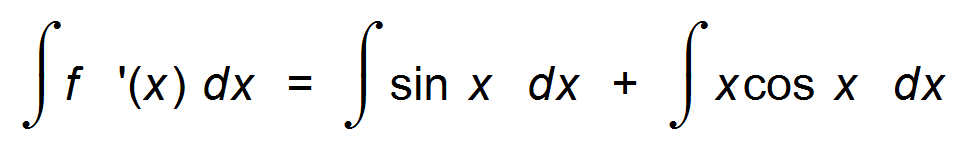
(b) Max gradient occurs when *f* ′′(*x*) = 0

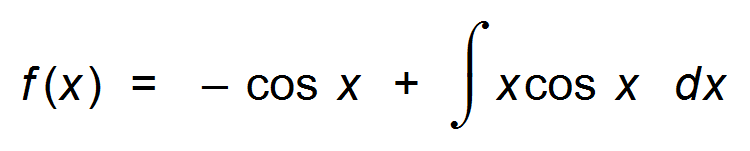
∴  ✓

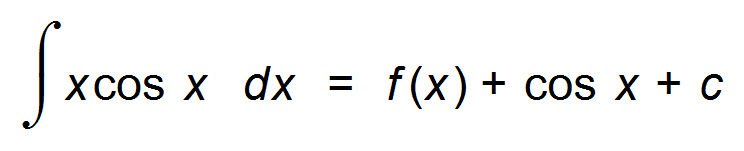
∴  ✓

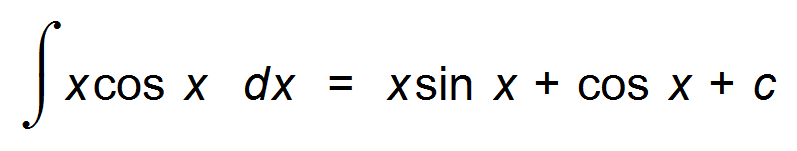
∴ Max gradient = 0.93 ✓ [8]

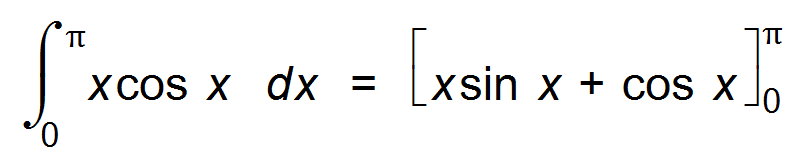
16. (a)  ✓✓

(b) (i)  ✓

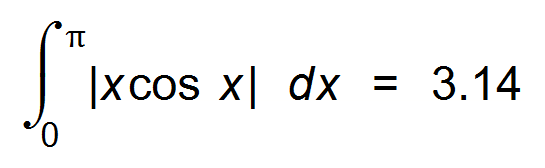
∴  ✓

∴  ✓

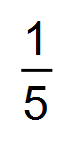
∴ 

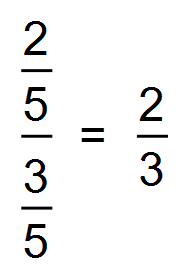
(ii)  ✓

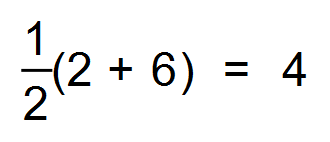
= (0 − 1) − (0 + 1) = −2 ✓

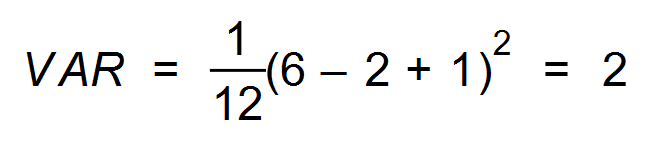
(c)  ✓ ✓ [9]

17. (a) Uniform ✓

(b) (i)  ✓

(ii)  ✓

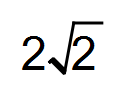
(iii)  ✓

(iv)  ✓

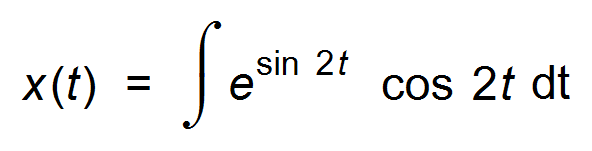
∴ Std Dev = ✓

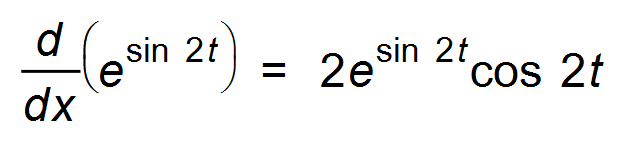
(c) (i) E(*Y*) = 3 − 2(4) = −5 ✓

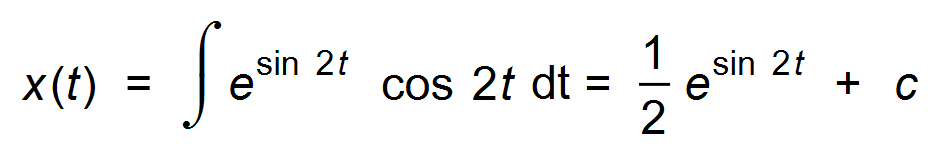
(ii) Std Dev(*Y*) = 2(Std Dev(*X*))

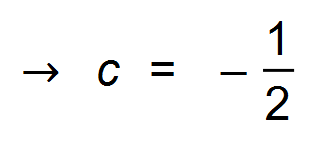
∴ =  ✓

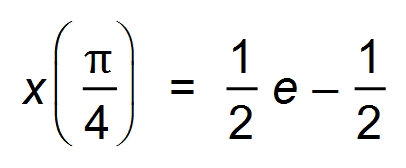
∴ VAR(Y) =  ✓ [9]

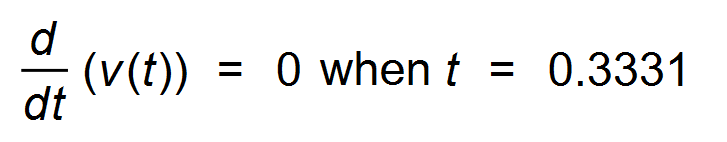
18. (a)  **

Since 

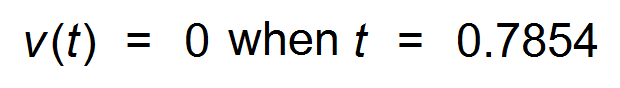
∴ ** ✓✓

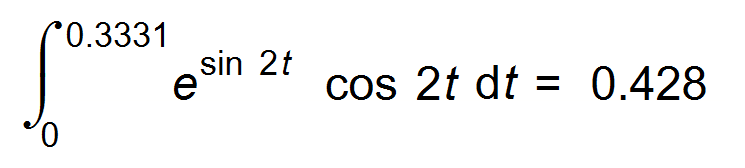
Since x(0) = 0 

∴  ✓

(b)  **  ✓





∴ Total distance =  ✓✓ [6]