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**MATHEMATICS**

**METHODS**

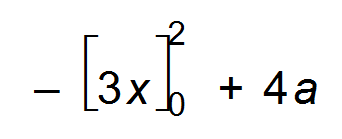
**UNITS 3 & 4**

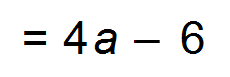
**Semester Two**

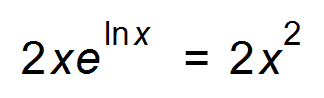
**2019**

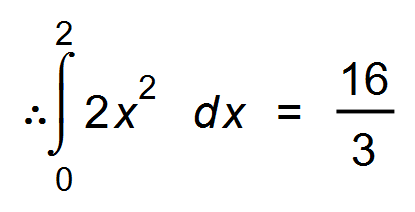
**SOLUTIONS**

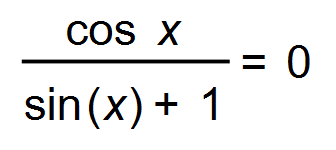
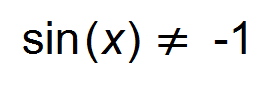
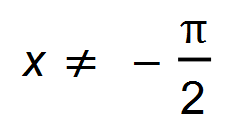
***Calculator−free Solutions***

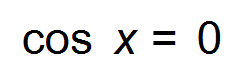
1. (a)  ✓

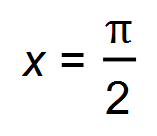
 ✓

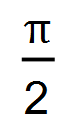
(b)  ✓

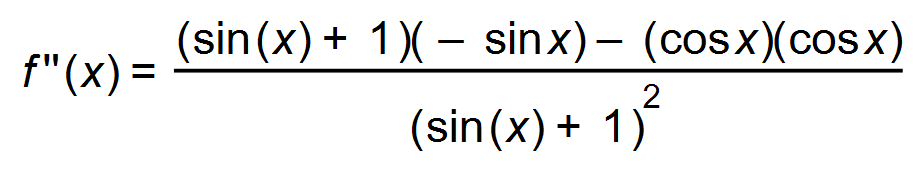
 ✓ [4]

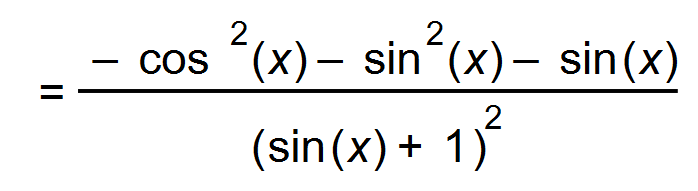
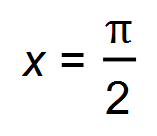
2. (a)  (where therefore  ) ✓

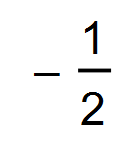


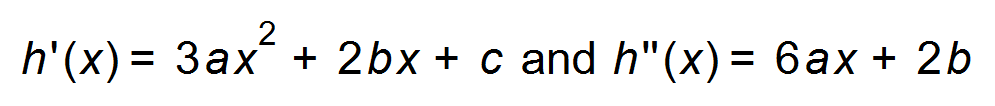
 ✓

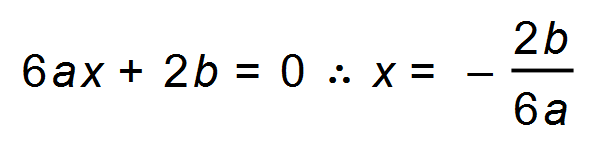
Stationary point at (  , ln 2 ) ✓

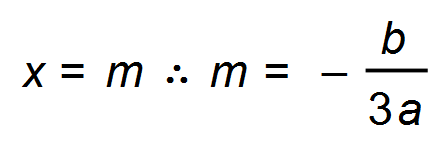
(b)  ✓

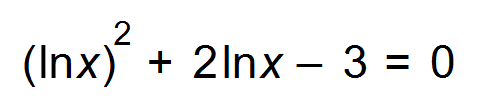
 |  ✓

= therefore maximum turning point. ✓ [6]

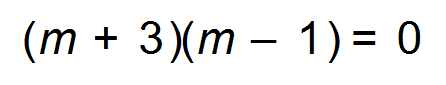
3.  ✓

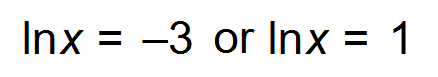
 ✓

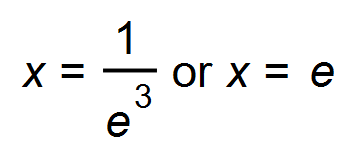
 ✓ [3]

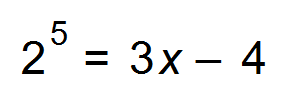
4. (a) (i) **

Let ln *x =m*

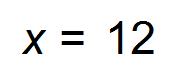
 ✓

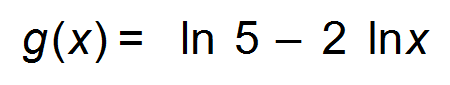
 ✓

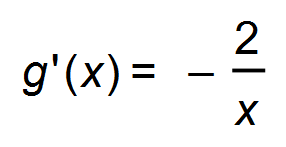
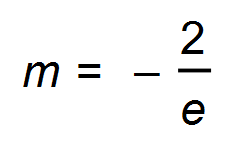
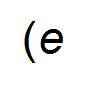
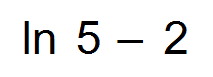
 ✓

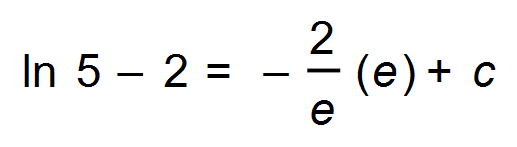
(ii)  ✓

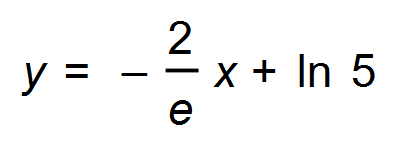
36 = 3*x*

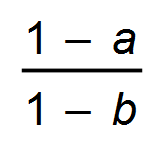
** ✓

(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 ✓

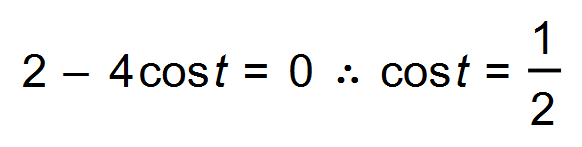
The confidence interval is about the population proportion and not

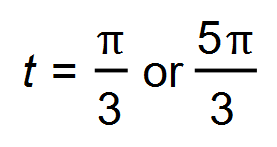
about the individual Australian households ✓

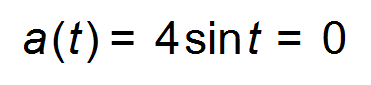
(iii) True ✓

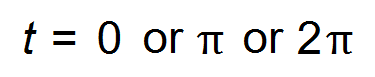
(iv) True ✓ [8]

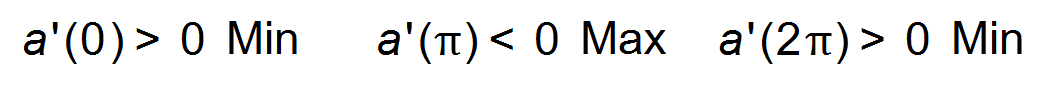
(the centre of the interval contains the sample proportion)

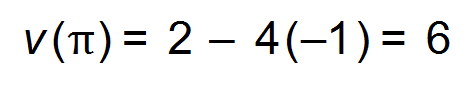
6. (a) 

 ✓✓

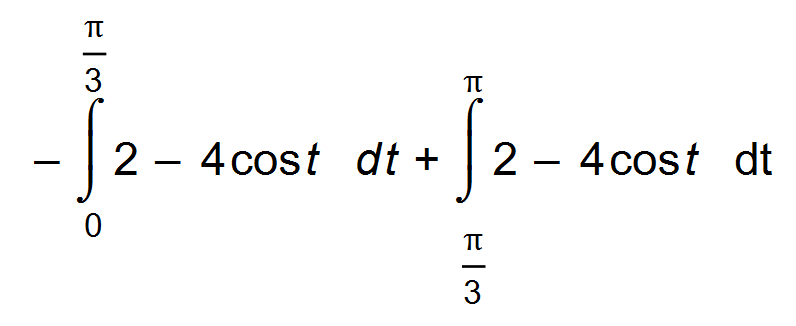
(b) 

 ✓

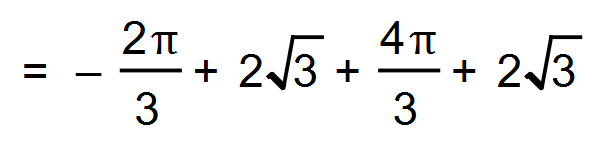
 ✓

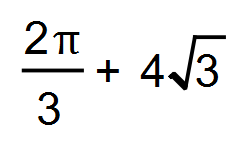


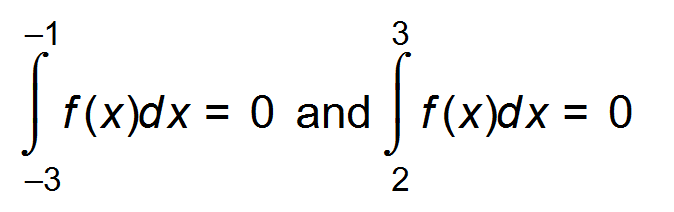
Max velocity is 6m/s ✓

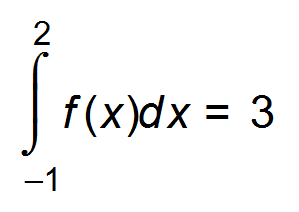
(c)  ✓

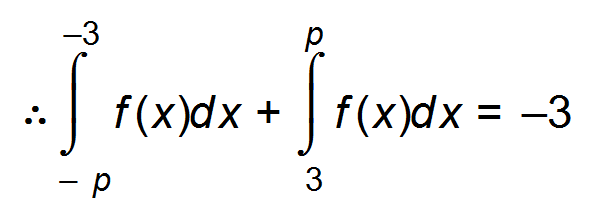
= + ✓

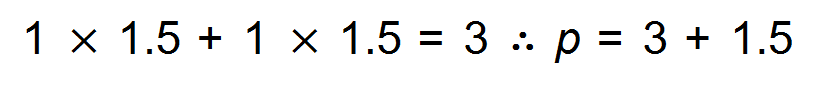
 ✓

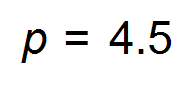
= m. ✓ [9]

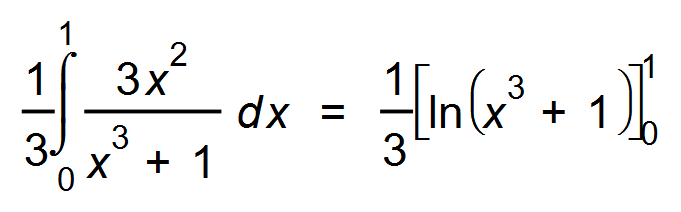
7. (a) 

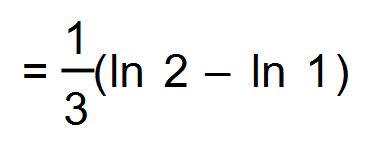
 ✓

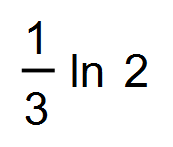
 ✓

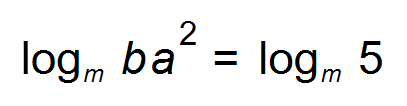


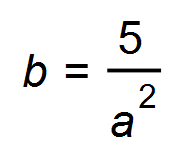
 ✓

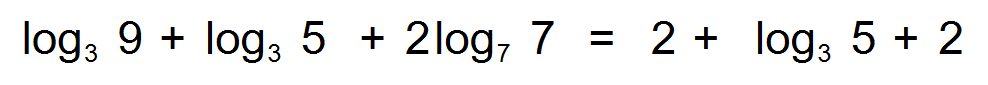
(b)  ✓

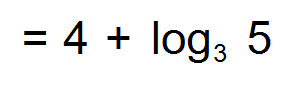
 ✓

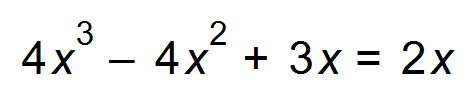
=  ✓ [6]

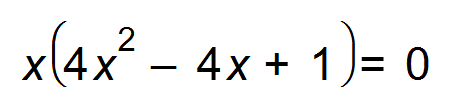
8. (a)  ✓

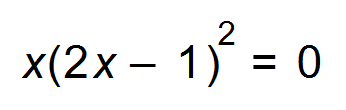
 ✓

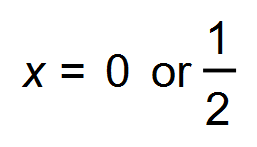
(b)  ✓

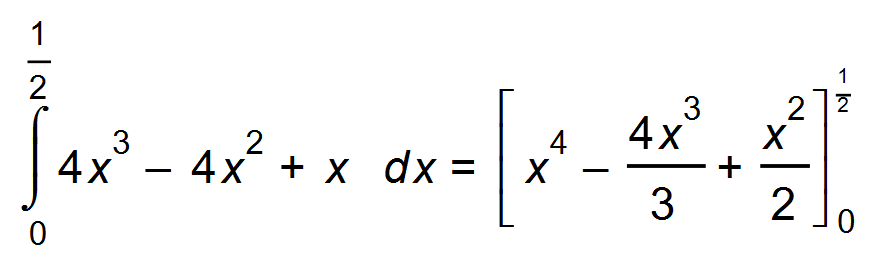
 ✓ [4]

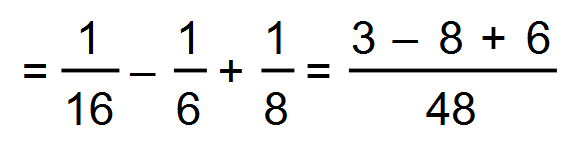
9. 

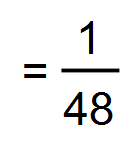




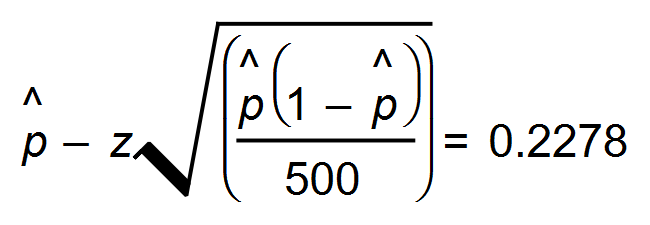
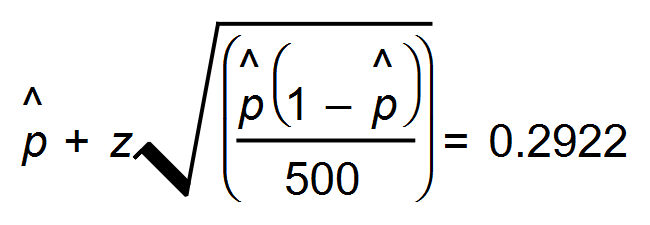
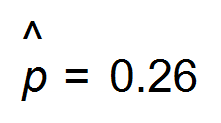
 ✓

 ✓

 ✓

 units2  ✓ [4]

***Calculator−assumed Solutions***

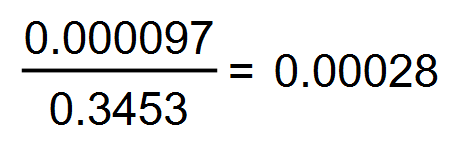
10. (a) and✓  ✓

0.26 of 500 = 130. ✓

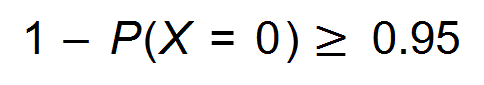
(b) *z =* 1.641 Therefore 90 % confidence level. ✓✓ [5]

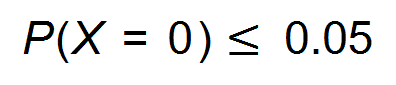
11. (a) (i) *n* = 20 p = 0.63

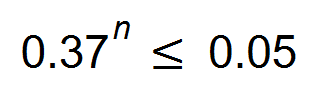
P (X ≥ 14) = 0.3453 ✓

(ii) P (X = 20 | X 14) =  ✓✓

(b) P(X1) 0.95



 ✓

 ✓

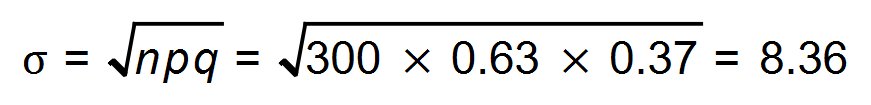
*n* = 3.01

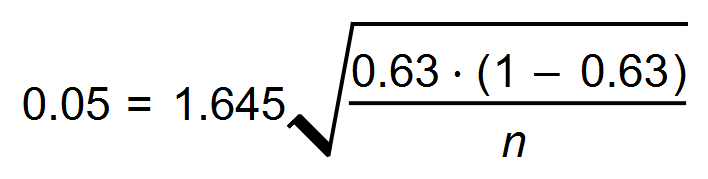
4 people would need to be selected ✓

(c) E(X)= np

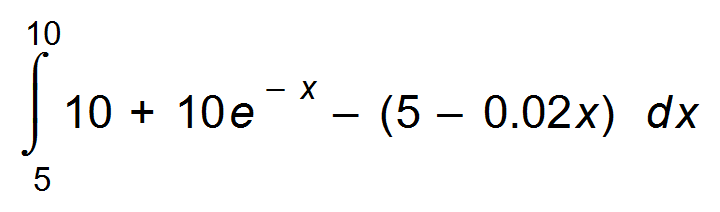
= 300 x 0.63

= 189 ✓

 ✓

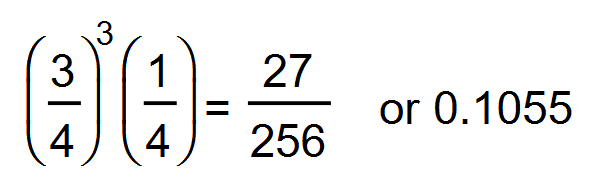
(d)  ✓

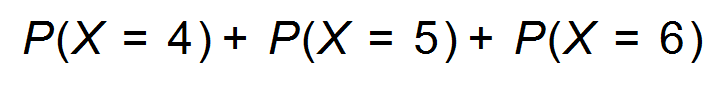
*n* = 253 credit card holders ✓ [10]

12.  ✓✓

= 25.81693

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

13. (a) (i)  ✓

(ii)  ✓

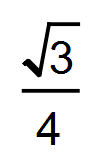
= 0.1055 + 0.079101 + 0.059326

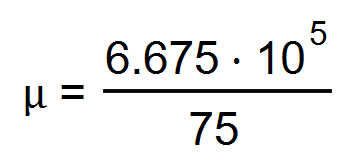
= 0.243927 ✓

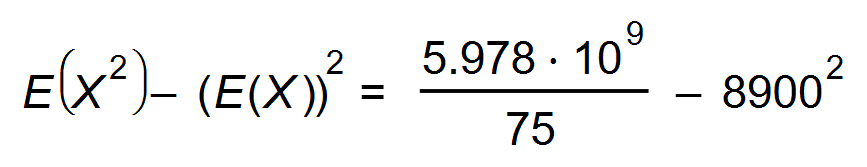
(b) (i) Discrete, independent probability ✓

two outcomes: Success or fail ✓

(ii) E(X) = 0.25 ✓

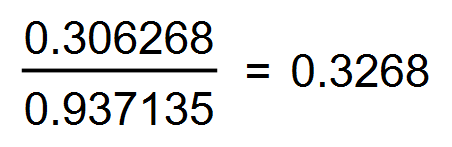
Standard deviation = = 0.43301 ✓ [7]

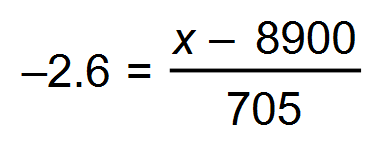
14. (a)  = 8900 litres ✓

(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]

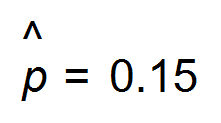
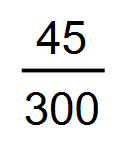
16. (a) Self-selective sample and therefore not representative of the population. ✓

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

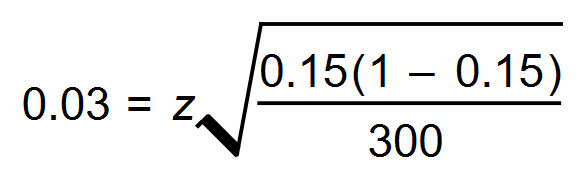
(b) Logical answer for example:

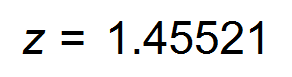
a randomly selected sample from the general public is used ✓

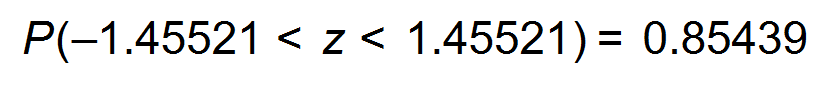
(c) 0.03 ✓

(d) Therefore point estimate = 0.15 or ✓

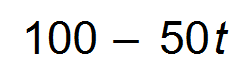
(e)

 ✓

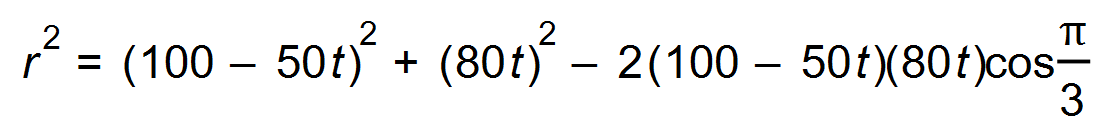
 ✓

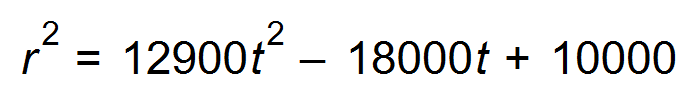


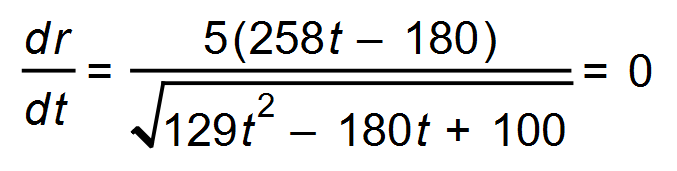
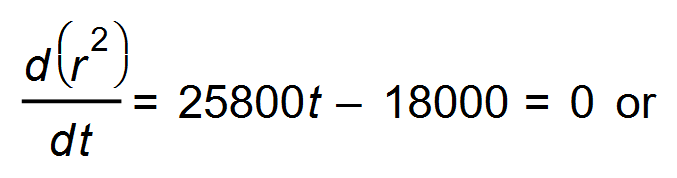
85.4% confidence level ✓ [8]

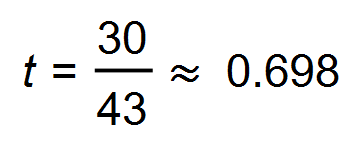
17. (a) At time *t*, the distance from *B* to *S* is. ✓

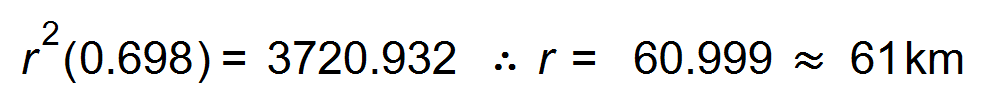
At time *t*, the distance from *A* to *S* is 80*t.* ✓

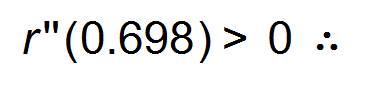
Cosine rule ✓

Therefore 

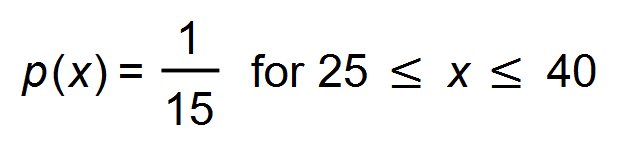
(b) ✓

 ✓

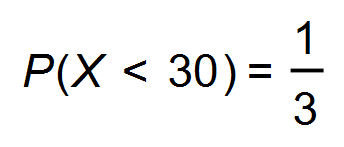
 ✓

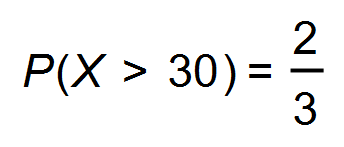
minimum ✓

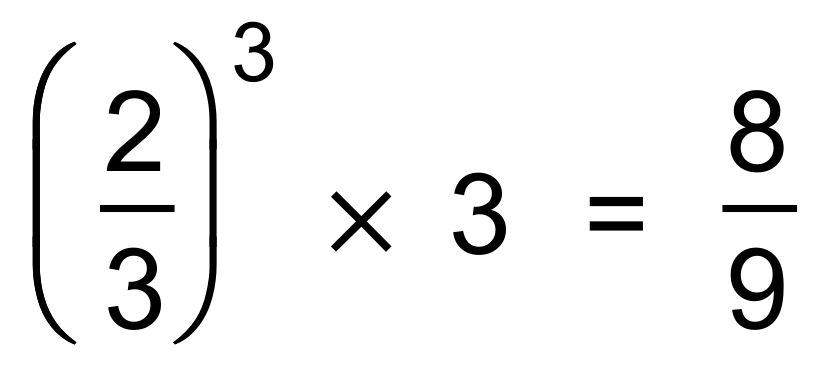
The minimum distance is 61 km. [7]

18. (a)  and 0 otherwise ✓

(b) 32.5 min ✓

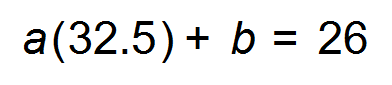
(c)  ✓

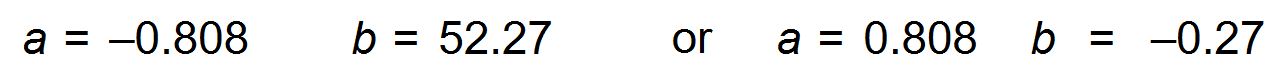
(d) (i)  ✓

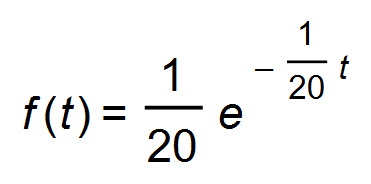
(ii)  ✓

(e) E(X) = 32.5 Var(X)= 18.75 ✓

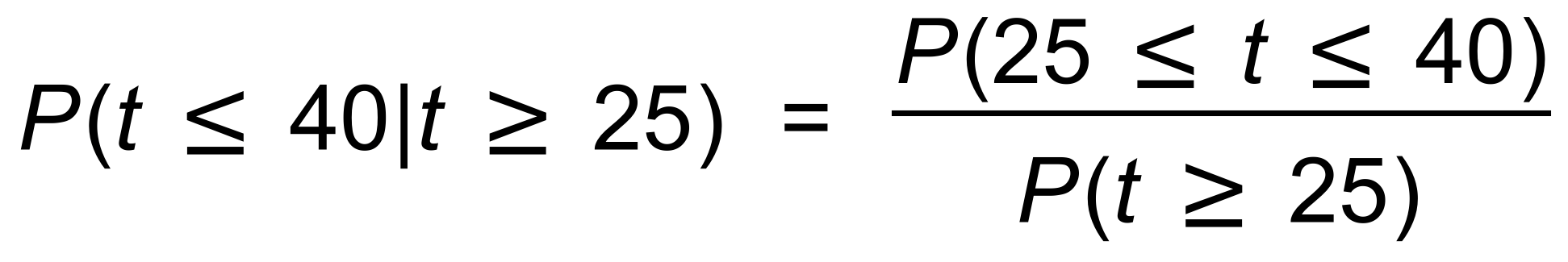
 ✓

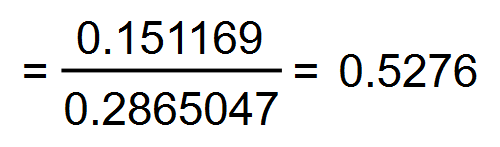
 ✓

 ✓ [9]

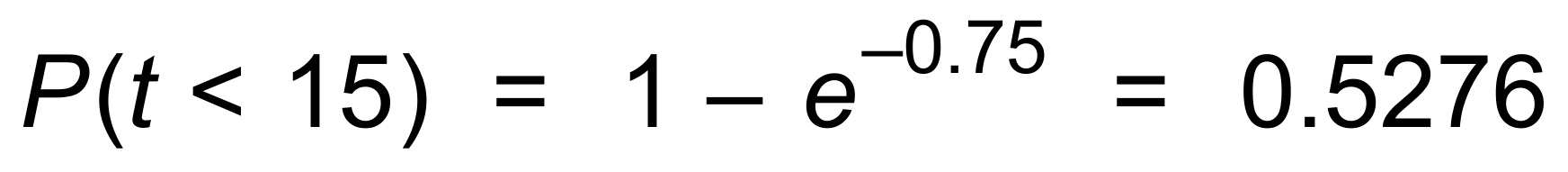
19. (a)  for t > 0 ✓✓

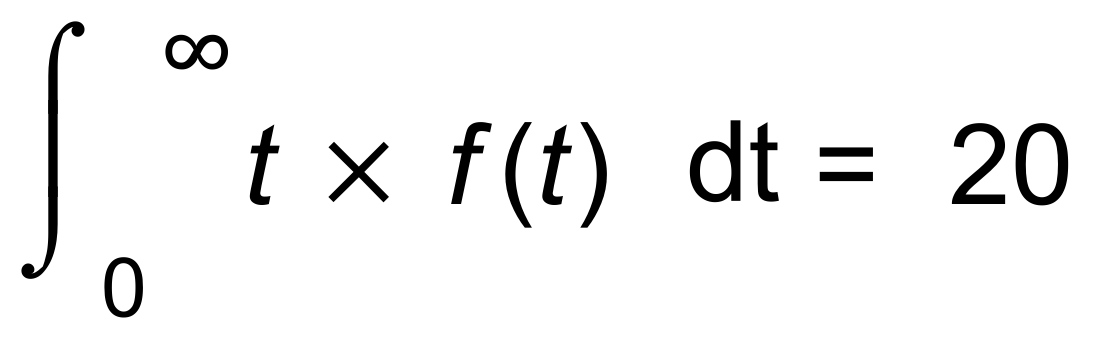
(b) F(20) = 0.6321 ✓

(c) 

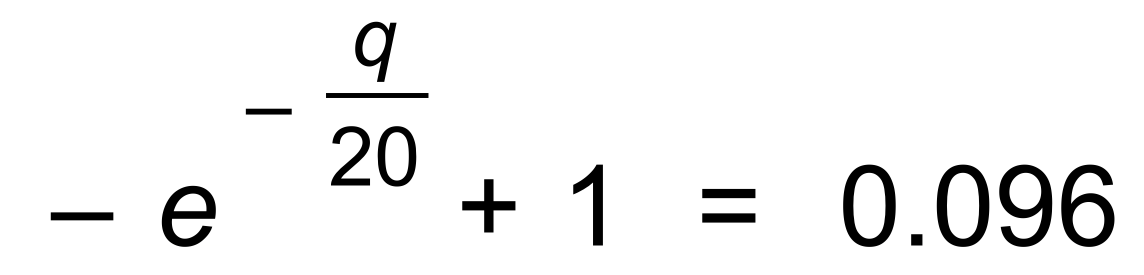
 ✓✓

or

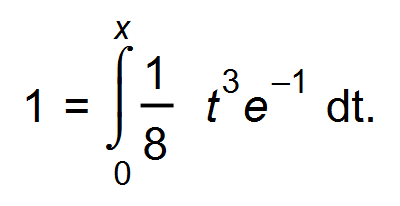


(d) E(*t*) = 

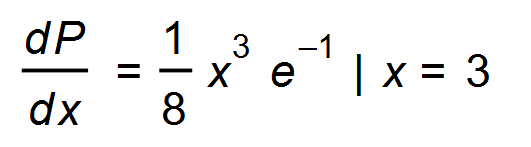
20 months is the mean time (or *k* = 20 = μ) ✓

(e) 

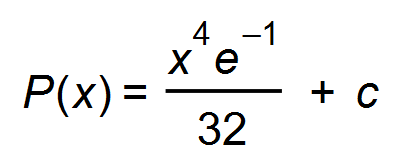
∴ *q* = 2.02 therefore just over 2 months ✓ [7]

20. (a)  ✓

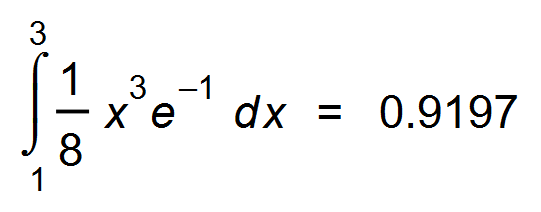
*x* = 3.0539 ✓

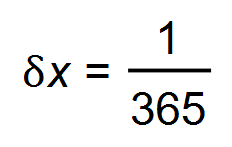
(b)  ✓

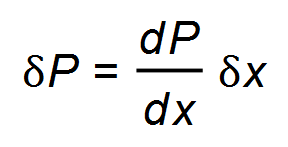
=1.2416 ✓

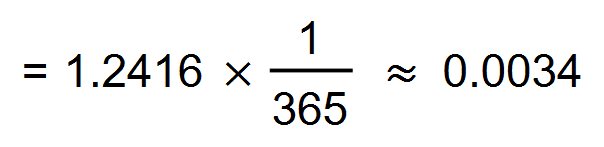
(c) 

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

or  ✓✓

(d)  ✓



 ✓✓ [9]

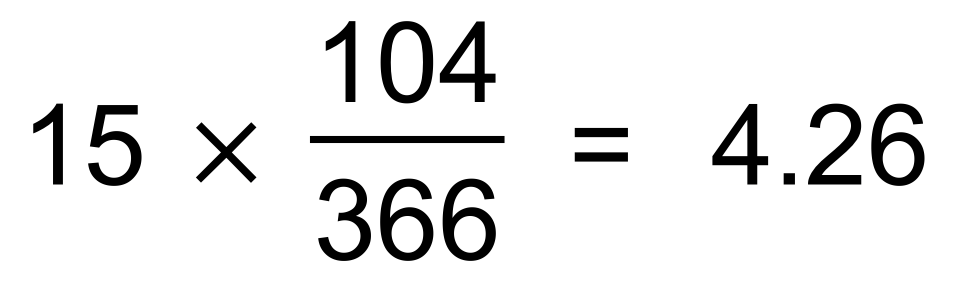
21. (a) 0.02275 x 3000 = 68.25 ∴ 68 people ✓

(b) (i) $75 538.04 ✓

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

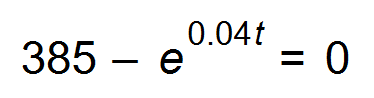
(c) New mean = $66 875 ✓

Standard deviation = $7687.50 ✓

(d)  ✓

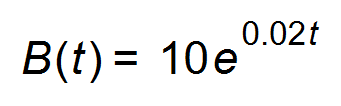
Therefore 4 interns ✓ [8]

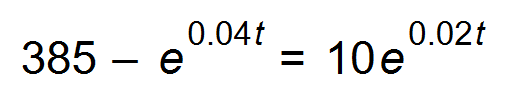
22. (a) 384 carp ✓

(b) 

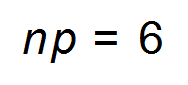
*t* = 148.8 months ✓

In the 149th month

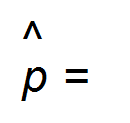
(c)  ✓

 ✓

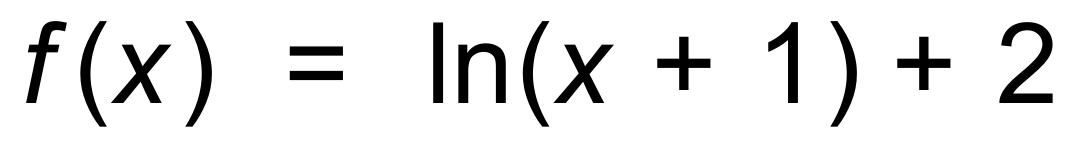
*t* = 136.2 months after the intro of bass (the 137th month) ✓ [5]

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]