2016 ATAR Math Exams

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Applications

150 marks total of which 107 from 1's and 2's (71%)

6 rounding instructions

Q4 – arithmetic is back!

Question 4

(a) Given the sequence 256, 128, 64, 32, …

(ii) Deduce a rule for the n^{th} term of this sequence. H… leaving your answer as a fraction. (3 marks)

```
256(1/2)^(n-1)
                256·(1/2)^(n-1)
ans|n=15
                1/64
```

(b) Use the recursive definitions given to state the first **three** terms of each of the following sequences.

(ii) $T_{n+1} = 1.5T_n,\ T_2 = 7.5$ (2 marks)

```
5
                5
ans×1.5
                7.5
ans×1.5
                11.25
```

(c) Consider the sequence 12, 7, 2, –3, …

By deducing a rule for the n^{th} term, or otherwise, determine which term of the sequence is –168. (3 marks)

```
12+(n-1)(-5)=-168
                -5·(n-1)+12=-168
solve(ans,n
                {n=37}
```

Question 7 (9 marks)

Julie buys a car with a purchase price of $13 000. However, she h… car to depreciate in value. The value of the car after n years can b… recursive rule.

$$T_{n+1} = 0.85T_n,\ T_0 = 13\ 000$$

(a) Complete the table below to show the value of the car at th… nearest dollar.

n	0	1	
Value of car after n years ($)	13 000		

(b) Use the information above to determine the rate of deprecia…

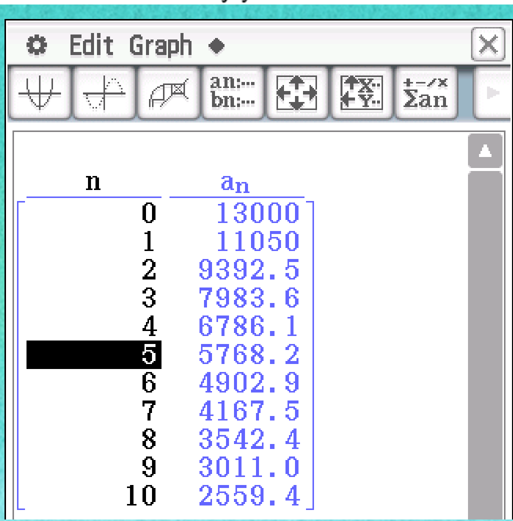
(c) Determine a rule for the n^{th} term of the sequence of values f…

```
Edit Graph
Recursive | Explicit
[x] an+1=0.85·an
    a0=13000
[ ] bn+1:
    b0=0
[ ] cn+1:
    c0=0

an+1=0.85·an
 n    an
 0    13000
 1    11050
 2    9392.5
 3    7983.6
 4    6786.1
 5    5768.2
7983.625
Deg   Real
```

(d) Determine the value of Julie's car after eight years, correct to the nearest dollar. (2 marks)

(e) Julie decides that she will sell her car at the end of the year in which its value drops to half of the purchase price. After how many years should she sell her car? (2 marks)



Question 8 **(17 marks)**

An experiment was conducted to determine whether there was any relationship between the maximum tidal current, in centimetres per second, and the tidal range, in metres, at a particular marine location. (The tidal range is the difference between the height of high tide and the height of low tide.) Readings were taken over a period of 12 days and the results are shown in the following table.

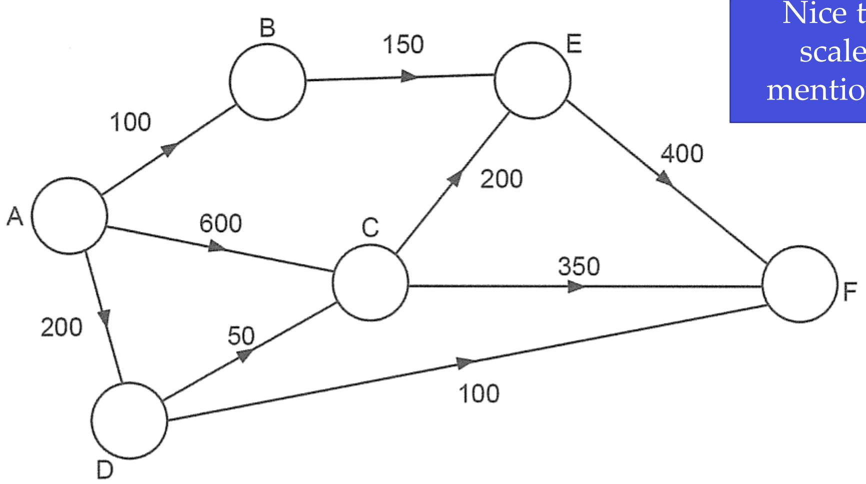
Tidal range	2.0	2.4	3.0	3.1	3.4	3.7	3.8	3.9	4.0	4.5	4.6	4.9
Maximum tidal current	15.2	22.0	25.2	33.0	33.1	34.2	51.0	42.3	45.0	50.7	61.0	59.2

Straightforward bivariate data question addressing many syllabus items.
Unusual for no variables to be defined anywhere in question.

Question 9 **(8 marks)**

The network below shows the maximum rate of water flow (in litres per minute) through a system of water pipes from a source at A.

Nice to see a 'small-scale' network, as mentioned in syllabus

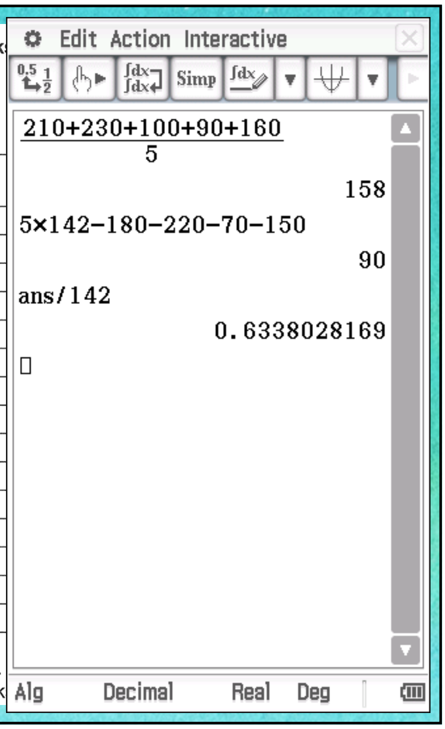


Question 10 **(11 marks)**

A school canteen manager recorded the number of ice-creams sold for three weeks. The data are recorded in the table below, together with some calculations.

	Sales day (d)	Ice-cream sales	Weekly mean	Percentage of weekly mean
Monday	1	210		132.9%
Tuesday	2	230		145.6%
Wednesday	3	100	B	63.3%
Thursday	4	90		57.0%
Friday	5	160		101.3%
Monday	6	190		128.4%
Tuesday	7	230		155.4%
Wednesday	8	90	148	60.8%
Thursday	9	80		54.1%
Friday	10	150		101.4%
Monday	11	180		126.8%
Tuesday	12	220		154.9%
Wednesday	13	A	142	C
Thursday	14	70		49.3%
Friday	15	150		105.6%

(a) Determine the values of A, B and C, giving the value of C correct to one decimal place. (4 marks)



(b) (i) Use the average percentage method to complete the table below by calculating the seasonal index for Wednesday. (1 mark)

Day	Seasonal index
Monday	129.4% = 1.294
Tuesday	152.0% = 1.520
Wednesday	
Thursday	56.8% = 0.568
Friday	102.8% = 1.028

Routine time series question

(ii) Use the seasonal index to determine the deseasonalised number of ice-cream sales for Tuesday of Week Three, correct to the nearest 10. (2 marks)

(c) The equation of the least-squares line used to forecast the deseasonalised number of ice-cream sales is

$$\text{deseasonalised number of ice-creams} = -1.695d + 161.16.$$

(i) Describe the trend in the number of ice-cream sales over time. (1 mark)

(ii) Predict the **actual** number of ice-cream sales for Friday of Week Four. (3 marks)

Question 11 **(10 marks)**

The data in the table below, taken from those surveyed by the Australian Bureau of Statistics, show estimates for the number of persons 15 years and over who participated in sport and physical recreation in Western Australia, Tasmania and Victoria.

Participation in Sport and Physical Recreation, 2013–14

Persons Participating								
Western Australia	**15–17 years**	**18–24 years**	**25–34 years**	**35–44 years**	**45–54 years**	**55–64 years**	**65 years+**	**Total**
Males ('000)	43.3	80.9	149.1	113.7	116.6	85.6	74.0	663.2
% of males	71.6	67.6	70.9	66.4	68.2	63.8	51.4	65.6
Females ('000)	30.3	84.3	131.8	111.4	107.8	82.8	76.5	*A*
% of females	61.6	70.6	67.3	61.5	64.2	60.7	48.1	61.9
Total ('000)	73.6	165.2	280.9	*B*	224.4	168.4	150.5	1288.1
Tasmania	**15–17 years**	**18–24 years**	**25–34 years**	**35–44 years**	**45–54 years**	**55–64 years**	**65 years+**	**Total**
Males ('000)	7.6	16.5	23.2	23.6	25.4	19.5	23.5	139.3
% of males	73.4	71.4	81.3	77.7	72.7	55.7	57.4	68.5
Females ('000)	7.8	14.1	22.0	22.3	27.2	22.0	20.7	136.1
% of females	79.0	69.0	74.3	70.0	74.3	62.9	46.7	65.5
Total ('000)	15.4	30.6	45.2	45.9	52.6	41.5	44.2	275.4
Victoria	**15–17 years**	**18–24 years**	**25–34 years**	**35–44 years**	**45–54 years**	**55–64 years**	**65 years+**	**Total**
Males ('000)	74.5	202.3	267.9	268.7	218.2	192.6	164.1	1388.3
% of males	69.4	65.1	62.4	67.9	59.7	60.1	44.0	61.7
Females ('000)	79.9	159.7	276.3	296.7	240.5	184.6	211.9	1449.6
% of females	68.4	62.5	63.7	71.9	62.6	55.8	49.8	61.4
Total ('000)	154.4	362.0	544.2	565.4	458.7	377.2	376.0	2837.9

Use the information in the table to answer the following questions.

(a) Determine the values of A and B for the WA data (2 marks)

(b) Which State, age and gender category had the highest rate of participation in sport and physical recreation? (3 marks)

(c) Which State had a higher percentage of females than males participating in sport and physical recreation in the 35-44 years category? (1 mark)

(d) Compare and comment on the participation rates in the 55-64 category with those in the younger age groups. (2 marks)

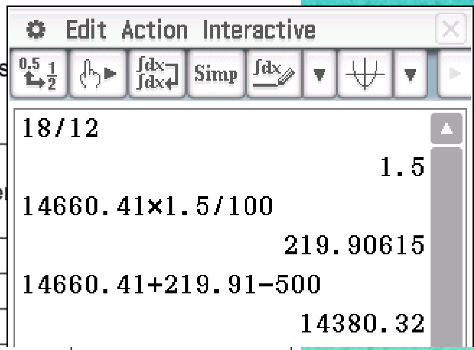
(e) Determine the total number of females in Victoria who were surveyed. (2 marks)

???

Question 12 **(11 marks)**

Thomas has borrowed $16 000 from a bank at a reducible interest rate of 18% per annum with interest accrued and repayments made monthly. Standard repayments are set at $500 per month.

The table below shows the progress of the loan for the first six months rounded to the nearest cent.



Month	Amount owing at beginning of month	Interest for the month	Repayme	
1	16 000.00	240.00	500.00	
2	15 740.00	236.10	500.00	
3	15 476.10	232.14	500.00	
4	15 208.24	228.13	500.00	14 936.37
5	14 936.37	224.04	500.00	14 660.41
6	14 660.41	A	500.00	B

(a) What is the monthly interest rate? (1 mark)

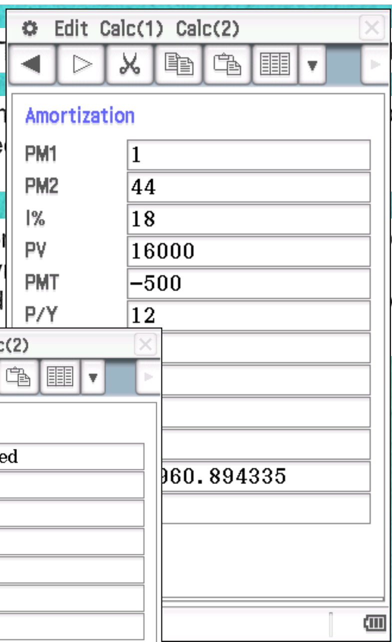
(b) Determine the values of A and B. (2 marks)

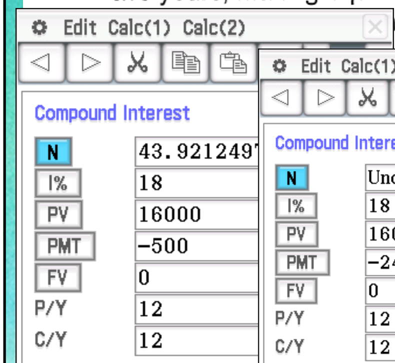
(c) Determine the length of time it will take Thomas to pay off the loan. (1 mark)

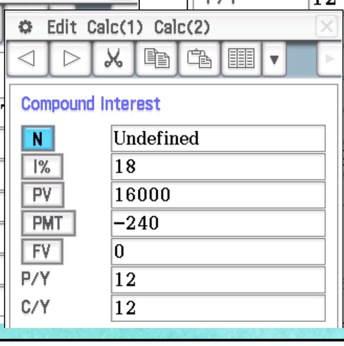
(d) Determine the total amount … the loan. (3 marks)

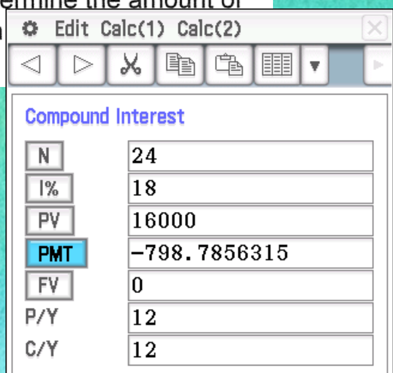
(e) The bank suggests that Thor… f $240 per month. Describe how this would affe… unt he pays over the duration of the loan. (2 marks)

(f) After listening to advice, Thor… off the loan completely in two years, making equal pay… Determine the amount of …eed… pen…









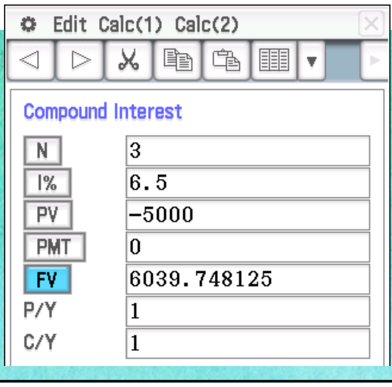
Question 13 **(6 marks)**

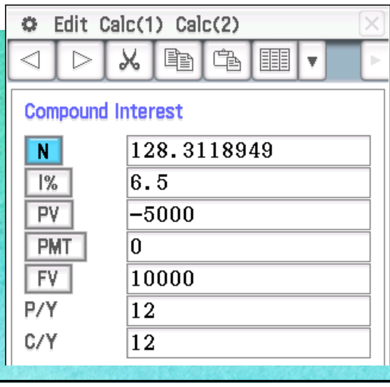
Simon has $5000 that he wants to invest for a period of time without touching it.

(a) If he chooses to invest this money in an account earning compound interest at the rate of 6.5% per annum, determine the:

(i) value of his investment after three years, if interest is paid annually. (1 mark)

(ii) time required for him to double his investment, if interest is paid monthly. (2 marks)





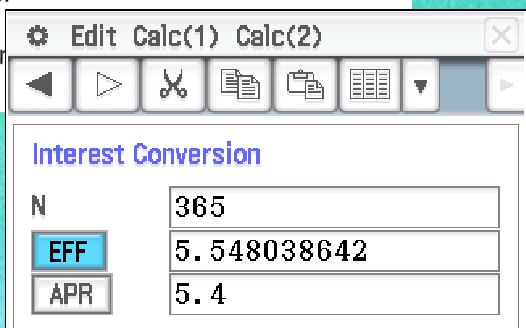
(b) Simon is currently deciding between two options and wishes to compare them.

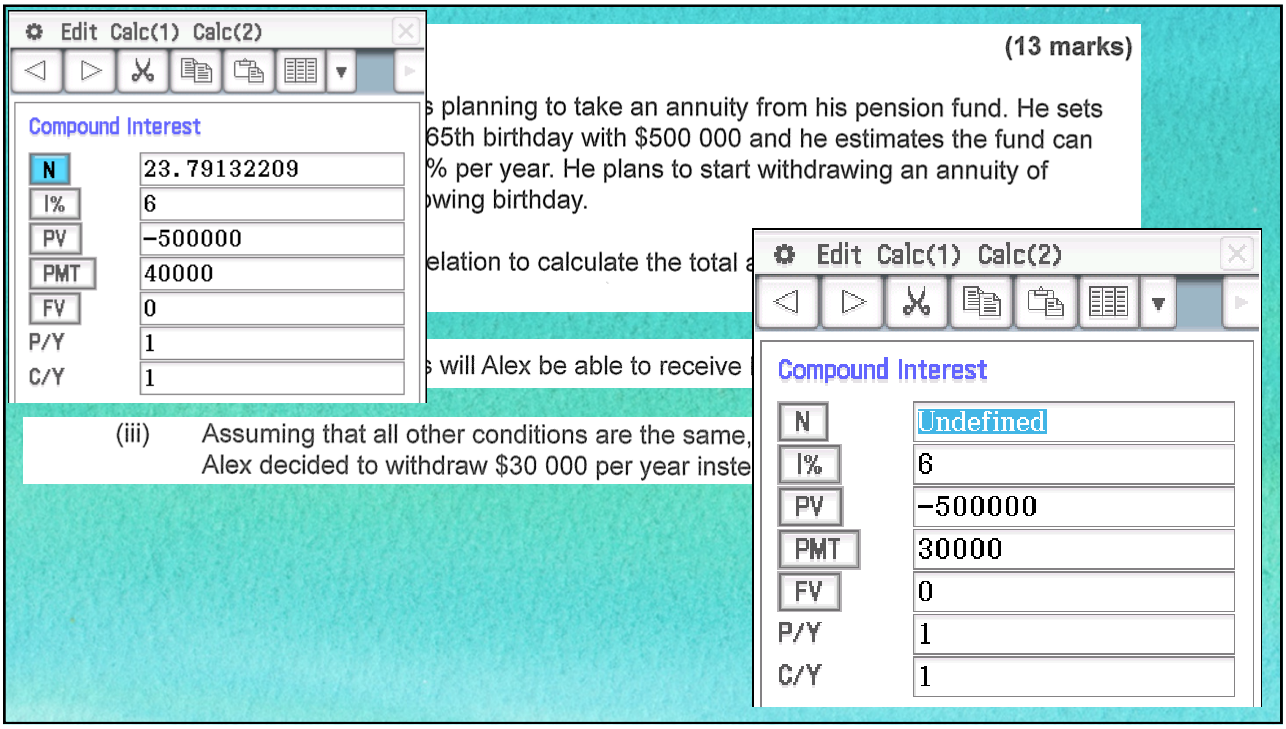
Option A: Invest the $5000 in an account earning compound interest at the rate of 5.5% per annum, with interest paid monthly.

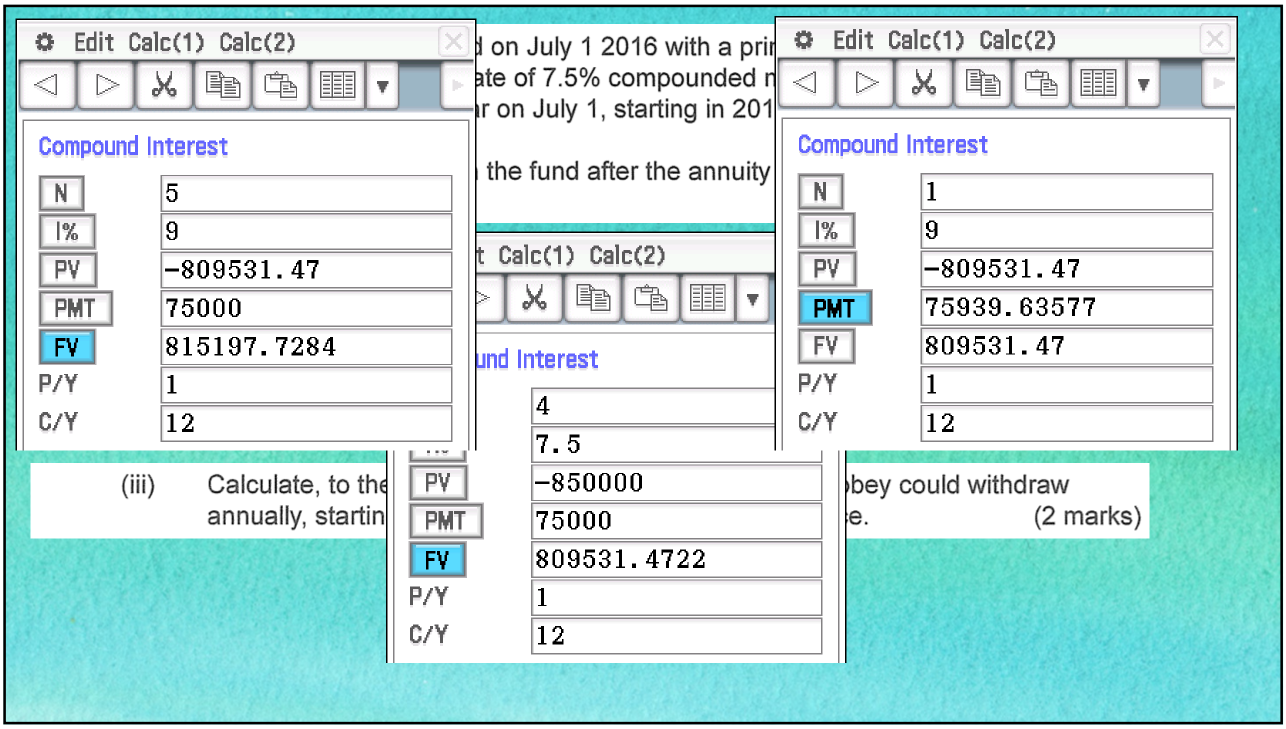
Option B: Invest the $5000 in an account earning compound interest at the rate of 5.4% per annum, with interest paid daily.

He decides to calculate the effective annual rate of interest for each option, in order to compare the possible investments. He determines that Option A has an effective annual rate of interest of 5.64%, correct to two decimal places.

Calculate the effective annual rate of interest for Optio[n B] and hence decide on the better option for Simon.




(13 marks)
s planning to take an annuity from his pension fund. He sets
65th birthday with $500 000 and he estimates the fund can
% per year. He plans to start withdrawing an annuity of
owing birthday.
elation to calculate the total a
s will Alex be able to receive
(iii) Assuming that all other conditions are the same,
Alex decided to withdraw $30 000 per year inste
Edit Calc(1) Calc(2)
Compound Interest
N 23.79132209
I% 6
PV -500000
PMT 40000
FV 0
P/Y 1
C/Y 1
Edit Calc(1) Calc(2)
Compound Interest
N Undefined
I% 6
PV -500000
PMT 30000
FV 0
P/Y 1
C/Y 1


d on July 1 2016 with a pri
ate of 7.5% compounded m
r on July 1, starting in 201
the fund after the annuity
(iii) Calculate, to the
annually, startin
bey could withdraw
e. (2 marks)
Edit Calc(1) Calc(2)
Compound Interest
N 5
I% 9
PV -809531.47
PMT 75000
FV 815197.7284
P/Y 1
C/Y 12
t Calc(1) Calc(2)
und Interest
4
7.5
PV -850000
PMT 75000
FV 809531.4722
P/Y 1
C/Y 12
Edit Calc(1) Calc(2)
Compound Interest
N 1
I% 9
PV -809531.47
PMT 75939.63577
FV 809531.47
P/Y 1
C/Y 12

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Specialist

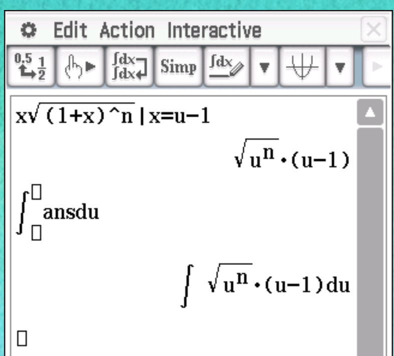
150 marks total of which 20 from 1's and 2's (13%)

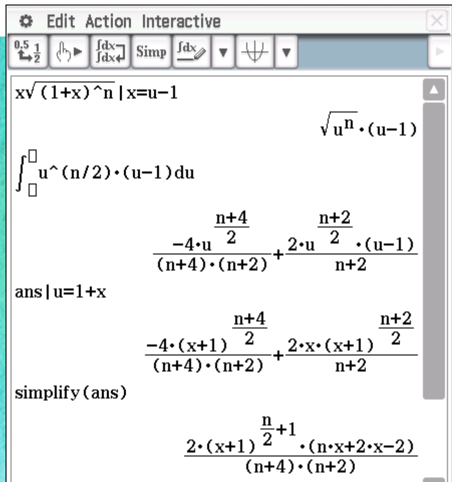
6 rounding instructions

Question 9 **(5 marks)**

Consider the integral $I = \int x\sqrt{(1+x)^n}\ dx$, where n is any positive integer.

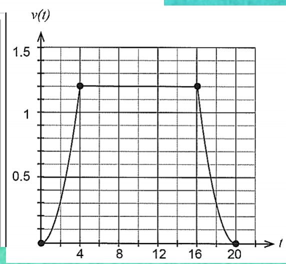
Using the substitution $u = 1 + x$ and an appropriate anti-derivative, develop a simplified expression for I in terms of x and n.





Question 11 **(7 marks)**

A lift goes up within a high rise building so that its velocity $v(t)$ is given by the graph shown below. The maximum velocity of the lift during its ascent is 1.2 ms^{-1}. For the first four seconds, the acceleration is given by $a(t) = kt$. For the final four seconds of its ascent, the lift decelerates at the same rate.



(a) Show that the value of the constant $k = \frac{3}{20}$

$\int 1\,dv = \int k \times t\,dt$

$v = \frac{k \cdot t^2}{2}$

solve(ans | v=1.2 | t=4, k

$\left\{k = \frac{3}{20}\right\}$

$\frac{3}{20} \times 2 \times 0.1$

(b) Using the increment[...] [...]ange in velocity v from $t = 2$ to $t = 2.1$ secon[...] (2 marks)

$\int_0^4 \frac{3t^2}{20 \times 2}\,dt$

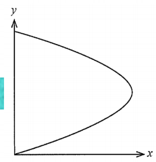
$\frac{8}{5}$

ans×2+12×1.2

(c) Determine the total distance that the lift travels upwards during its ascent, correct to the nearest 0.1 m. (3 marks)

Question 13 **(5 marks)**

The graph of the curve $2x = \sin(y)$ is sketched for $0 \le y \le \pi$.



(a) Determine the expression for $\frac{dy}{dx}$ in terms of y. (2 marks)

(b) Determine the area of the region bounded by the curve $2x = \sin(y)$ and the y axis. (3 marks)

Edit Action Interactive

2x=sin(y)

$2 \cdot x = \sin(y)$

impDiff(

$y' = \frac{2}{\cos(y)}$

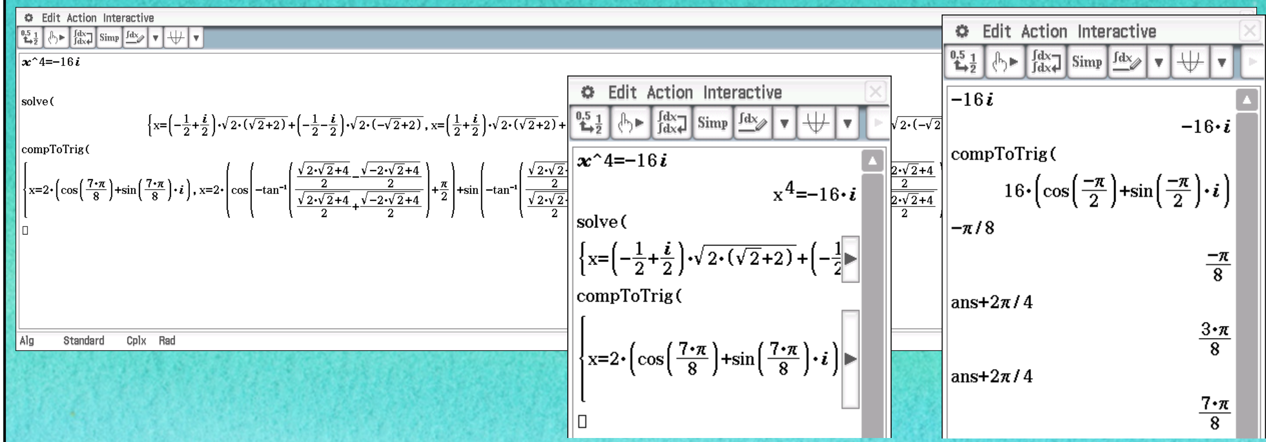
$\int_0^{\pi} \frac{\sin(y)}{2}\,dy$

1

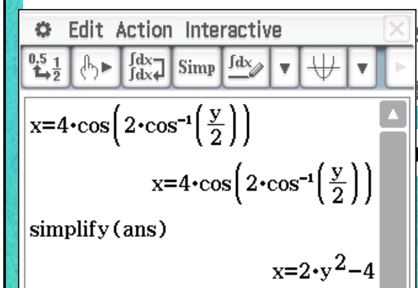
Question 14 (7 marks)

Consider the complex equation $z^4 = -16i$.

(a) Solve the equation giving all solutions in the form $r\,\text{cis}\,\theta$ where $-\pi < \theta \le \pi$. (4 marks)



Question 16



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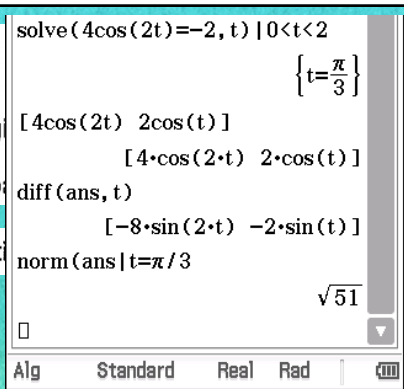
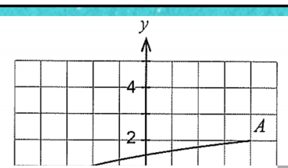
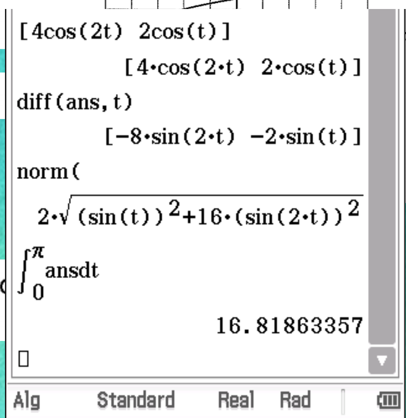


es where



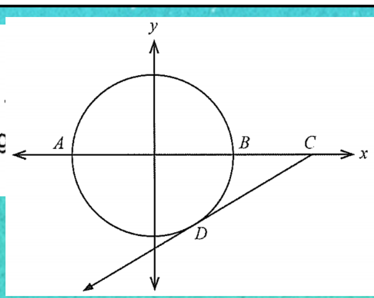


(b) Determine the speed of the particle, correct to 0.01 cm per secon
the point where $x = -2$.

(c) Write the expression, in terms of trigonometric functions, for the distance the particle will travel along its path in travelling from point A to point B. Do **not** evaluate this expression. (3 marks)

Q

T ... qu ... being
in ... tai ... secting
C ... √3



x^2+y^2=16

$x^2+y^2=16$

impdiff(

$y'=\frac{-x}{y}$

$y-(-2\sqrt{3})=\frac{-2}{-2\sqrt{3}}(x-2)$

$y+2\cdot\sqrt{3}=\frac{\sqrt{3}\cdot(x-2)}{3}$

ans×√3

$\sqrt{3}\cdot(y+2\cdot\sqrt{3})=x-2$

simplify(ans)

$\sqrt{3}\cdot y+6=x-2$

Define $f(x)=-\sqrt{16-x^2}$

done

Define $g(x)=\frac{x-8}{\sqrt{3}}$

done

$\int_{-4}^{2}\pi f(x)^2dx$

$72\cdot\pi$

$\int_{2}^{8}\pi g(x)^2dx$

$24\cdot\pi$

$72\cdot\pi+24\cdot\pi$

$96\cdot\pi$

approx(

301.5928947

Alg Standard Real Rad

(a ... th ... in the form (3 marks)

(b ... o ... (1 mark)

The region bounded by the arc AD, ... xis is rotated about the x axis.

(c) Determine the volume of the ... est 0.01 cubic units. (4 marks)

$\frac{15}{\sqrt{50}}\Rightarrow s$

2.121320344

normCDf(173,177,s,175)

0.6542214138

8960/50

179.2

normCDf(−∞,179.2,s,175)

0.9761425599

... the Sa ... han
... y distrib ... tan
... d up 50 ... the
... will be

x_1InvN	169.53584
x_2InvN	180.46416
prob	0.99
σ	2.121320344
μ	175

<< Back Help

Deg Real

Spec U34

Normal CDf

Result

n=37.960961

Left-Right=0

OK

Equation:

$n=\left(\frac{z\cdot\sigma}{e}\right)^2$

n= 37.9609612912912

z= 2.05374891063182

σ= 15

e= 5

Lower= −9E+999

Rad Real 1E−10

(b) total volume of water used is

Water is a scarce commodity and accuracy is required. The pool is topped up ... sample mean obtained is denoted by $\overline{W}$.

(c) If it is required that $P(a \le \overline{W} \le b) = 0.99$, then determine the values of ... correct to 0.1 litres.

(d) If the probability for the mean amount of water used differs from μ by less than five litres is 96%, find n, the number of waterings that need to be measured. (3 marks)

Q19 – Testing difference of means is NOT in our syllabus

A rival company called WolliWorks takes over the watering of the ornamental pool. Over 36 consecutive days, it was observed that the WolliWorks company used a total of 6.57 kilolitres. The standard deviation for the 36 days was also 15 litres.

A representative from the SavaDaWater company states that 'WolliWorks are using significantly more water than we did when we were filling this pool. They are wasting water'.

(e) Perform the calculations necessary to comment on this claim. (4 marks)

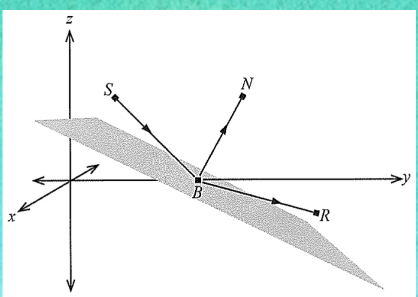
```
[6570/36,15,36,0.95]⇒[m,
            [182.5 15 36 0.95]
−invNormCDf(0,c,1,0)⇒z
                   1.959963985
s/√(n)⇒se
                           2.5
z×se⇒e
                   4.899909961
[m−e,m+e]
        [177.60009 187.39991]
```

Question 20 **(7 marks)**

A laser pointer at point S directs a highly focused beam of light towards a mirror. The beam bounces off the mirror at point B and is then reflected away from the mirror toward point R.

The mirror's surface is given by the equation $\underset{\sim}{r}\cdot(\underset{\sim}{j}+2\underset{\sim}{k})=9$ and the laser pointer is positioned at point S with position vector $-2\underset{\sim}{i}+3\underset{\sim}{j}+6\underset{\sim}{k}$. The laser pointer is held so that the beam is pointed in the direction $\underset{\sim}{d}_1=\underset{\sim}{i}+\underset{\sim}{j}-\underset{\sim}{k}$.

(a) Determine the position vector for point B. (4 marks)



Edit Action Interactive

$$\text{dotP}\left(\begin{bmatrix}-2+t\\3+t\\6-t\end{bmatrix},\begin{bmatrix}0\\1\\9\end{bmatrix}\right)=9$$

$$-9\cdot(t-6)+t+3=9$$

solve(ans, t

$$\{t=6\}$$

$$\begin{bmatrix}-2+t\\3+t\\6-t\end{bmatrix}|\text{ans}$$

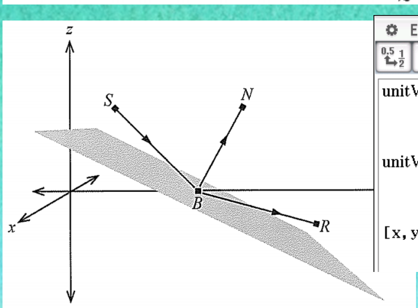
$$\begin{bmatrix}4\\9\\0\end{bmatrix}$$

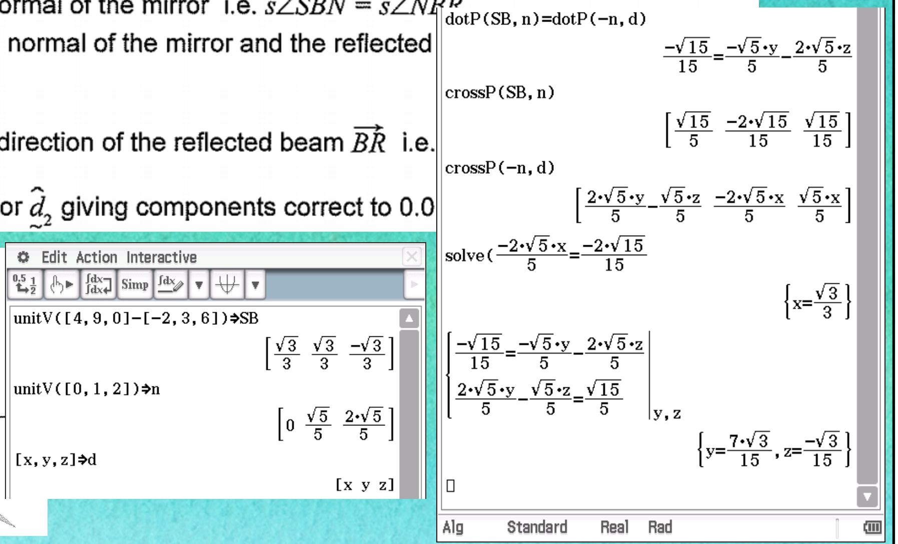
The laser beam is reflected away from the mirror so that:

- the angle of the incoming beam $\overrightarrow{SB}$ to the normal of the mirror is equal to the angle of the reflected beam $\overrightarrow{BR}$ to the normal of the mirror i.e. $s\angle SBN = s\angle NBR$
- the incoming beam $\overrightarrow{SB}$, the normal of the mirror and the reflected in one plane.

Let $\hat{\underset{\sim}{d}}_2$ = the unit vector in the direction of the reflected beam $\overrightarrow{BR}$ i.e.

(b) Determine the unit vector $\hat{\underset{\sim}{d}}_2$ giving components correct to 0.0





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Methods

150 marks total of which 58 from 1's and 2's (39%)

3 rounding instructions

Q4 & Q19 – poor match for syllabus dot points

Question 4 **(8 marks)**

The displacement x micrometres at time t seconds of a magnetic particle on a long straight superconductor is given by the rule $x = 5\sin 3t$.

(a) Determine the velocity of the particle when $t = \frac{\pi}{2}$. (3 marks)

(b) Determine the rate of change of the velocity when $t = \frac{\pi}{2}$. (3 marks)

Let v = velocity of the particle at t seconds.

(c) Determine $\int_0^{\frac{\pi}{2}} \frac{dv}{dt}\, dt$. (2 marks)

Syllabus dot points

The second derivative and applications of differentiation

3.1.12 identify acceleration as the second derivative of position with respect to time

Applications of integration

3.2.21 determine displacement given velocity in linear motion problems

3.2.22 determine positions given linear acceleration and initial values of position and velocity.

Question 19 (8 marks)

The displacement in centimetres of a particle from the point O in a

$x(t)=\frac{1}{3}\left(\frac{t}{2}-4\right)^2-2$ for $0 \le t \le 10$, where t is measured in second

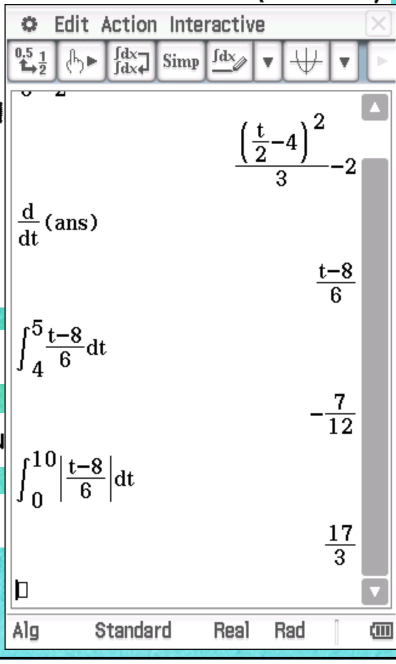
Calculate the:

(a) time(s) that the particle is at rest.

(b) displacement of the particle during the fifth second.

(c) maximum speed of the particle and the time when this occu

(d) total distance travelled in the first 10 seconds.



Question 9 (7 marks)

Fermium-257 … ose decay rate ca

$P = P_0e^{kt}$, whe … t is measured in … t and

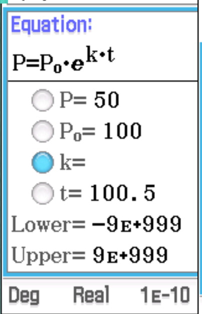
k is a constant … alf of the original

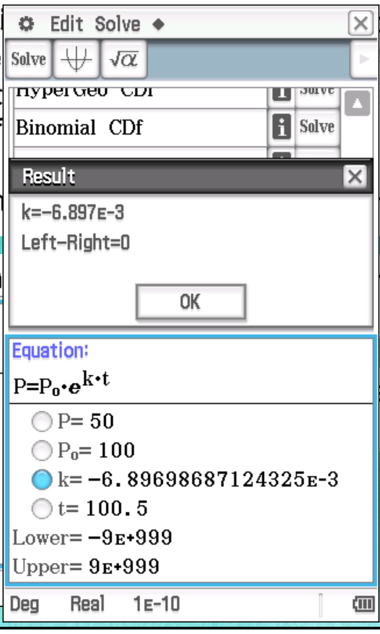
The half-life of

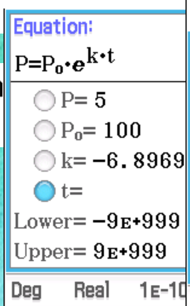
(a) Determ … nificant figures. … arks)

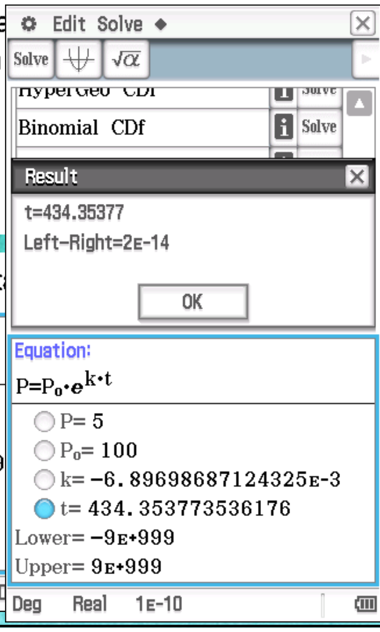
(b) How m … rams of the subst … arks)

… am … arks)









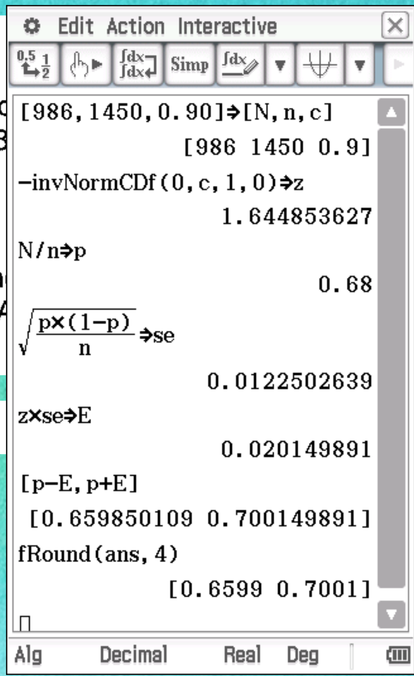
Question 10 (2 marks)

A survey in Western Australia was conducted on the po… Type A. Out of 1450 Year 12 students, the survey found that 98… …ulator.

Determine the following.

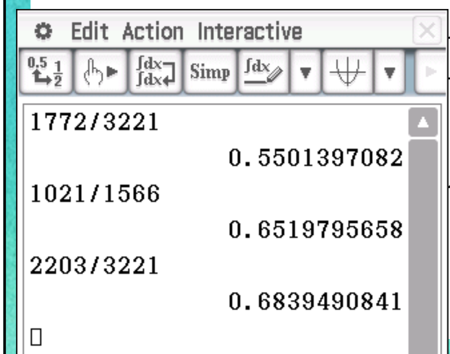
(a) A 90% confidence interval, to three decimal pla… …n Australian Year 12 students who use the Type A… …as made in calculating this interval? (3 marks)

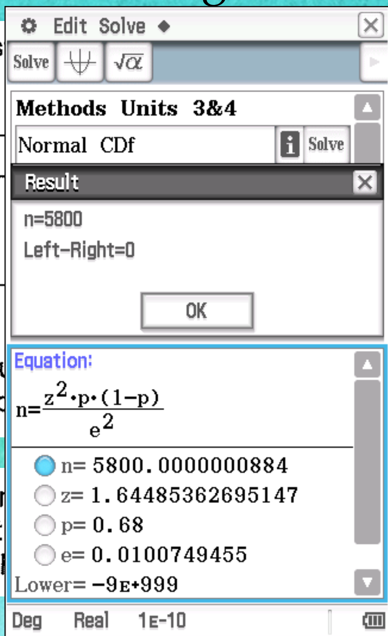
(b) The margin of error in this confidence interval. (2 marks)

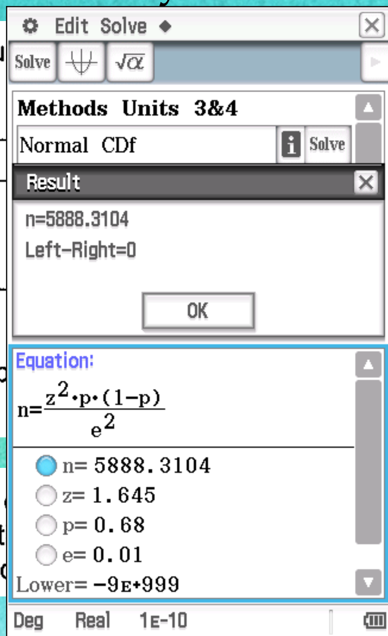


Q10 & Q20 - Hypothesis testing is NOT in our syllabus

Another three surveys of Year 12 s… u… across Australia.



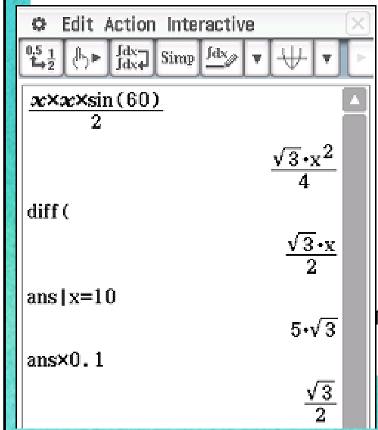


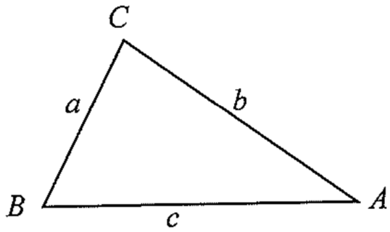


(d) Using the sample proportio… sample size that will halve t… Year 12 students who use t…

Question 11 **(3 marks)**

The area of a triangle can be found by the formula: $Area = \dfrac{ab \sin C}{2}$.





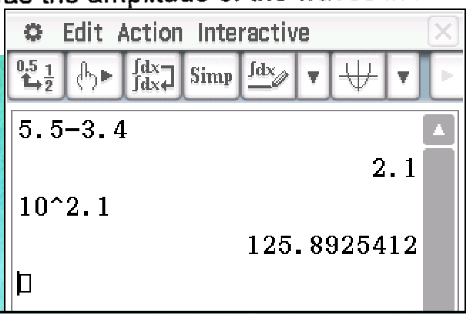
nula, determine the approximate change in area of an equilateral
10 cm, when each side increases by 0.1 cm.

Question 12 **(3 marks)**

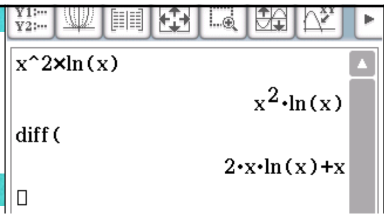
The Richter magnitude, M, of an earthquake is determined from the logarithm of the amplitude, A, of waves recorded by seismographs.

$M = \log_{10}\dfrac{A}{A_o}$, where A_o is a reference value.

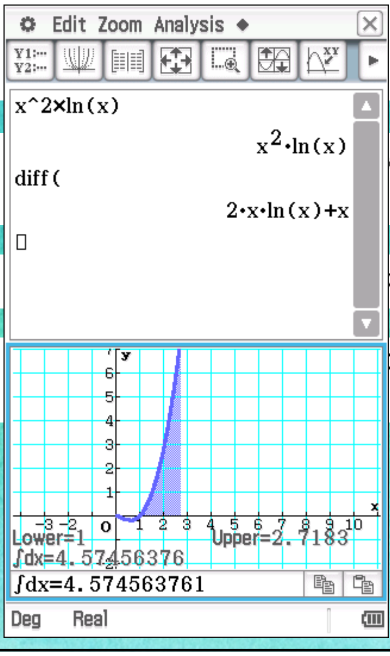
An earthquake in a town in New Zealand in November 2015 was estimated at 5.5 on the Richter scale, while the earthquake just north of Hayman Island measured 3.4 on the same scale. How many times larger was the amplitude of the waves in New Zealand compared to those at Hayman Island?



Question 13 **(10 marks)**



(a) (2 marks)



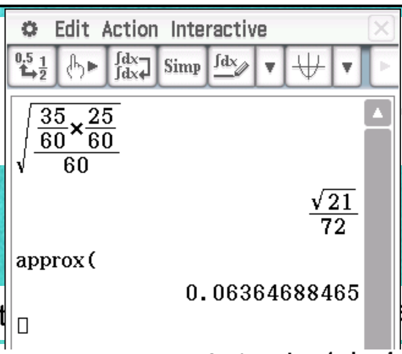
(b) (a), show that the graph of $y = x^2 \ln x$ has only one (3 marks)

(c) x, showing all features. (3 marks)

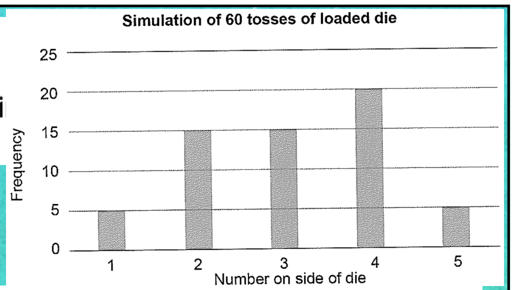
(d) by the graph of $y = x^2 \ln x$, the x axis, $x = 1$ and $x = e$. (2 marks)

Question 14

The simulation results.



e rolled 60 ti



(a) Calculat ers recorded in this simulation. (2 marks)

(b) Determine the mean and standard deviation for the sample proportion of prime numbers in 60 tosses, using the results above. (2 marks)

(c) It has been decided to create a confidence interval for the proportion of prime numbers using the simulation results on page 8. The level of confidence will be chosen from 90% or 95%. Explain which level of confidence will give the smallest margin of error. State this margin of error. (3 marks)

This simulation of 60 rolls of the die is performed another 200 times, with the proportion of prime numbers recorded each time and graphed.

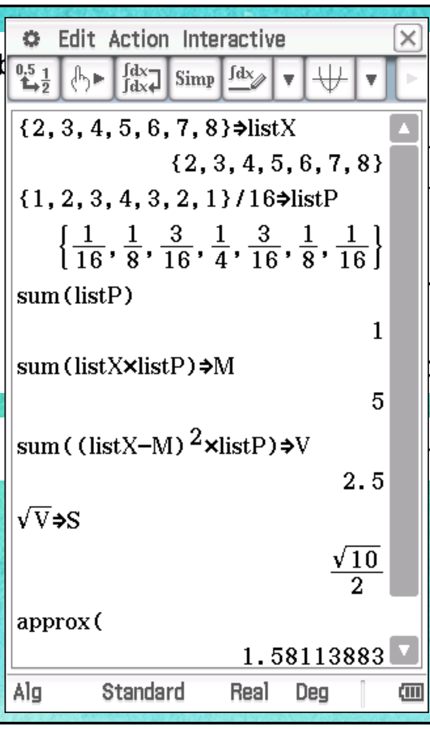
(d) Comment briefly on the key features of this graph. (2 marks)

Question 15 **(6 marks)**

A tetrahedral die has the numbers 1 to 4 on each face. When thrown, each side is equally likely to land facedown. Let X be defined as the sum of the numbers on the facedown side when the die is thrown twice.

(a) Complete the following table. (1 mark)

		Roll two			
	Sum of two rolls	1	2	3	4
Roll one	1	1 + 1 = 2	3		
	2	3			
	3		5		
	4				



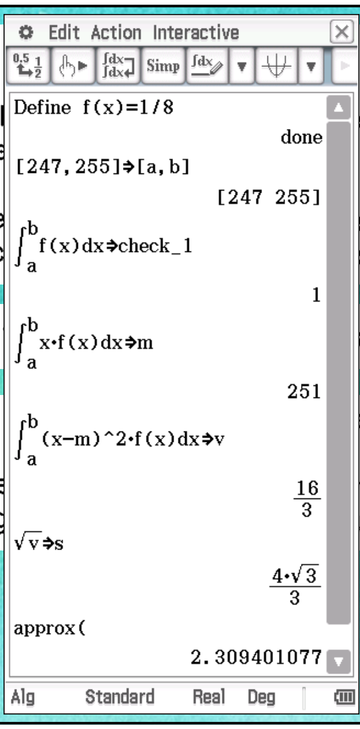
(b ... complete the probability distribution of X, which is given by (1 mark)

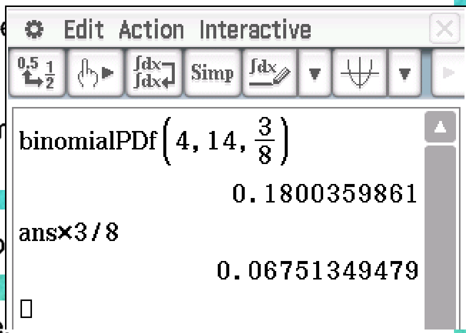
	3	4	5	6	7	8
						$\frac{1}{16}$

...bility of obtaining a sum of five or less. (2 marks)

...n and standard deviation for X. (2 marks)

Question 16 **(10 marks)**





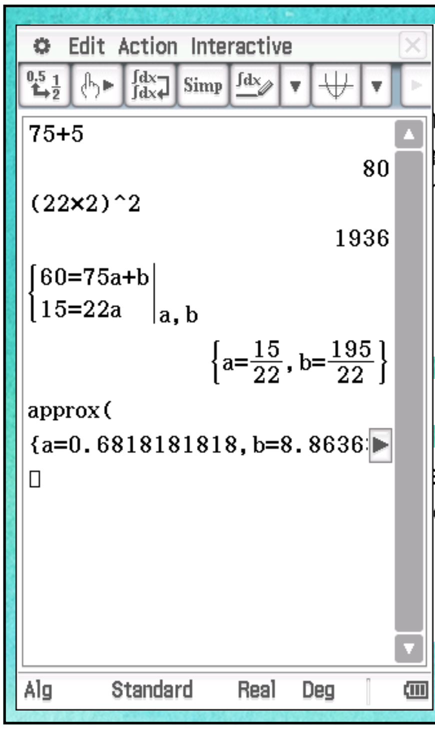
An automated mi… …s uniformly to be…
label on the bottle…

(a) Determine… …selected random…
machine c… …d amount.

(b) Calculate… …ation of the amo…

A worker selects… …lt, one at a time.

(c) Determine… …the selection of 15 bottles before five bottles
containing… …nt have been selected. (3 marks)



(7 marks)

…nination scores for all its Year 12 students taking Methods as a
…n percentage scores of all the Methods Year 12 students at the
…he mean was 75 with a standard deviation of 22.

(1 mark)

(2 marks)

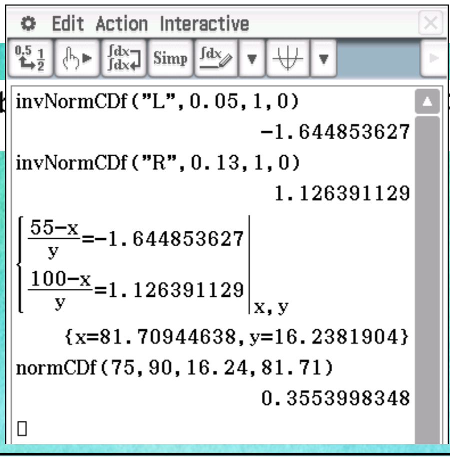
…e the results using the transformation $Y = aX + b$ where a and b
…d percentage scores. The aim is to change the mean to 60 and

a and b. (4 marks)

Question 18 **(6 marks)**

The waiting times at a Perth Airport departure lounge have been found to be normally distributed. It is observed that passengers wait for less than 55 minutes, 5% of the time, while there is a 13% chance that the waiting times will be greater than 100 minutes.

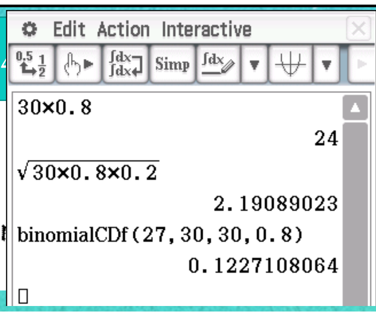
(a) Determine the mean and standard deviation for the waiting times at Perth Airport departure lounge. (5 marks)



(b) Determine the prob ... between 75 and 90 minutes. (1 mark)

Question 20 **(14 marks)**

How is each box filled? 24



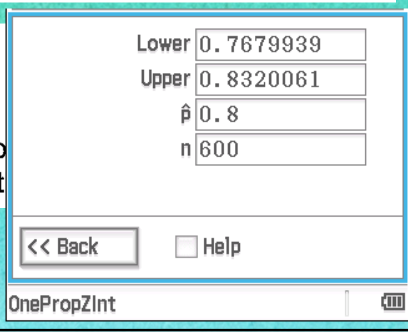
A chocolate factory produces chocolates of which 80% ... tes contains exactly 30 pieces.

(a) Identify the probability distribution of X = the nu ... ingle box and also give the mean and standard deviation. (3 marks)

(b) Determine the probability, to three decimal places, that there are at least 27 pink chocolates in a randomly selected box. (3 marks)

Quality Control collects samples sizes of 20 boxes and counts the total. ??

(c) Determine a 95% confidence interval for the proportion of p ... 20 boxes, using the assumption that 80% of chocolates in t ...



Edit Action Interactive

binomialPDf(1,3,0.05)
0.1

ects three samples and determines a 95% confidence interval each

4.3.10 use simulation to illustrate variations in confidence intervals between samples and to show that most, but not all, confidence intervals contain p

(e) Usin nu

Quality Co

Samp
Numb of pin chocola

(f) De

Unit 4 Overview: Statistical inference is one of the most important parts of statistics, in which the goal is to estimate an unknown parameter associated with a population using a sample of data drawn from that population. In the Mathematics Methods ATAR course, statistical inference is restricted to estimating proportions in two-outcome populations.

Question 21

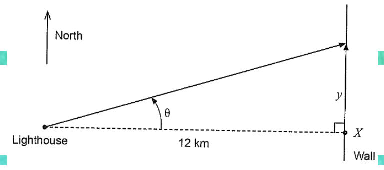
Related Rates!!! Why???

(6 marks)

A lighthouse is situated 12 km away from the shoreline, opposite point X as seen in the diagram below. A long brick wall is placed along the shoreline and at night the light from the lighthouse can be seen moving along this wall.

Let y = displacement of light on the wall from point X and θ = angle of the rotating light from the lighthouse.

The light is revolving anticlockwise at a uniform rate of three revolutions per minute ($\frac{d\theta}{dt} = 6\pi$ radians/minute).



(a) Show that $\frac{dy}{d\theta} = \frac{12}{\cos^2\theta}$. (3 marks)

(b) Determine the velocity, in kilometres per minute, of the light on the wall when the light is 5 km north of point X. (3 marks)

(Hint: $\frac{dy}{dt} = \frac{dy}{d\theta} \times \frac{d\theta}{dt}$)

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