

Note: All part questions worth more than 2 marks require working to obtain full marks.

Formula sheet provided: Yes

Task weighting: 10%

Marks available: 44 marks

Special items: Drawing instruments, templates, one page of A4 notes double-sided

Standard items: Pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Materials required: Up to 3 calculators/classpads allowed

Number of questions: 6

Time allowed for this task: 40 mins

Task type: Response

Student name: \_\_\_\_\_ Teacher name: \_\_\_\_\_

## COURSE METHODS YEAR 12 TEST FOUR 2022



Working out space

Q1 (4 marks) 4.2.5

The exam results, out of a 100, for a Methods exam at a particular school was found to be Normally Distributed. It was found that 21% of the students scored a result greater than 85 and 17% scored a mark less than 55. Determine the mean and standard deviation.

**Solution**

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invNormCDF("R", 0.21, 1, 0)
0.806421247
invNormCDF("L", 0.17, 1, 0)
-0.9541652531

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$$\begin{cases} 0.8064 = \frac{85 - \mu}{\sigma} \\ -0.9542 = \frac{55 - \mu}{\sigma} \end{cases} \quad \mu, \sigma$$

$$\{\mu = 71.25922981, \sigma = 17.03964558\}$$

**Specific behaviours**

- ✓ determines both z scores
- ✓ sets up one equation for mean and stdev
- ✓ sets up two equations for mean and stdev
- ✓ solves for mean and stdev

Note- answer only max of 2 marks

Q2 (2, 2, 3 &amp; 2 = 9 marks) 4.3.8

A 95% confidence interval was determined for the proportion of faulty factory parts made at a company. The interval length is 0.106 and the sample size of 200.

Determine the **expected length** of the interval for each change in isolation to 3 decimal places.

**Specific behaviours**

- ✓ states that support cannot be made with any reason
- ✓ one of the reasons stated above



- c) A 88% confidence AND a sample size of 150 was used.

Solution
<code>invNormCDf("C", 0.88, 1, 0)</code> <b>-1.554773595</b>
$L \propto z \frac{1}{\sqrt{n}}$ $L_1 = z_1 \sqrt{n_1}$ $L_2 = z_2 \sqrt{n_2}$ $= \frac{1.5548}{1.960} \sqrt{\frac{200}{150}} (0.106) = 0.1224$ $\approx 0.097$
Specific behaviours
<input checked="" type="checkbox"/> states quantile for 0.88 <input checked="" type="checkbox"/> shows ratio involving sample sizes <input checked="" type="checkbox"/> states length

- d) The true proportion of faulty parts does not lie in the stated interval. Does this suggest a sampling error was made? Justify.

Solution
Cannot tell if there is a sampling error as not all confidence intervals contain the true value of population proportion p.
Specific behaviours
<input checked="" type="checkbox"/> states no with any reason <input checked="" type="checkbox"/> states reason as above (Note – zero marks if no without any reason)

Edit Action Interactive
$\text{normCDF}\left(0.21, \infty, \sqrt{\frac{0.16 \cdot (1-0.16)}{300}}, 0.16\right)$ <b>9.081509174E-3</b>
Specific behaviours
<input checked="" type="checkbox"/> uses correct parameters <input checked="" type="checkbox"/> states prob

Q4 cont-

In a recent survey it was found that 18 people out of a sample of 200 were left handed.  
 c) For a 99% confidence interval, what is the margin of error based on this recent sample of 200?

Solution
<code>invNormCDf("C", 0.99, 1, 0)</code> <b>-2.575829304</b> $2.575829304 \sqrt{\frac{\frac{18}{200} \left(1 - \frac{18}{200}\right)}{200}}$ <b>0.05212475572</b>
Specific behaviours
<input checked="" type="checkbox"/> determines z quantile

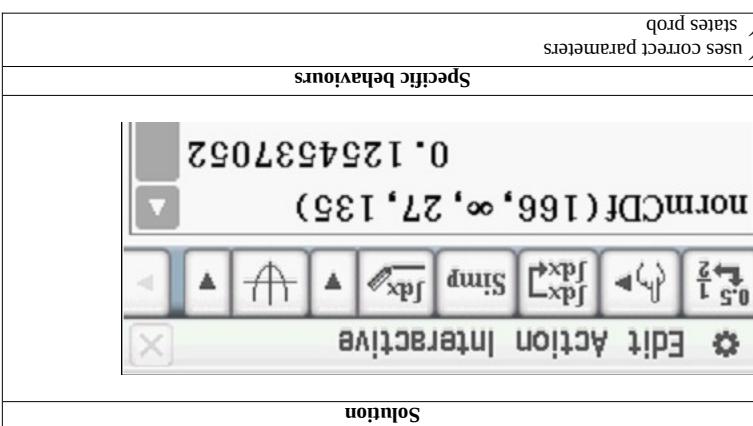
Specific behaviours	
Normal model goes from -infinity to plus infinity, both of which are impossible/impractical.	
Solution	

- c) Comment on the appropriateness of the Normal Model for the lengths of the boxes.

Specific behaviours	
Prob for short	
Box	Short
Length	0 to 45 mm
Probability	0.00043 (0.000)
Box	Long
Length	45 to 100 mm
Probability	0.097
Box	Very Long
Length	100 to 140 mm
Probability	0.476
Box	Greater than 140mm
Probability	0.427

- b) Complete the missing probabilities in the above table.

The boxes can be classified as the following.



- a) Determine the percentage of boxes that are longer than 166mm.

A parcel making factory makes boxes of the same width and heights but the lengths vary and are found to be Normally Distributed with a mean of 135 mm and a standard deviation of 27 mm.

Q3 (2, 2, 3, 3 & 3 = 18 marks) 4.2.5, 4.2.3, 3.3.1, 3.3.6, 3.3.7

Solution	

- b) Determine the approximate probability that in a sample of 300 people that the proportion of left handed people is greater than 0.2.

Solution	

- a) State the approximate distribution of  $p$  for sample sizes of 100.

In Australia it has been found that 16% of people are left-handed. Let  $p$  denote the proportion of people in the sample who are left handed. Samples of people are surveyed to ascertain the proportion that are left-handed. Let  $p$  denote the proportion of people in the sample who are left handed.

Q4 (3, 2, 3, 3 & 2 = 13 marks) 4.3.4, 4.3.5, 4.3.6, 4.3.9, 4.3.10

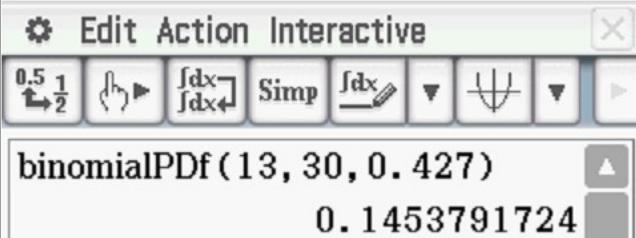
Solution	

Mathematics Department

Mathematics Department

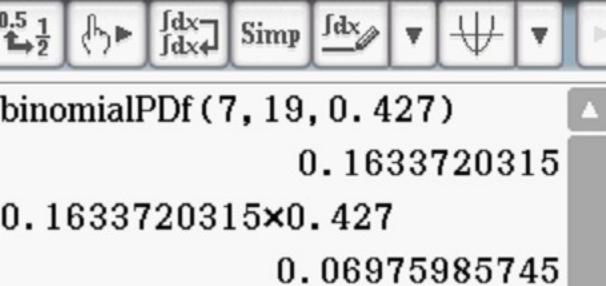
- ✓ discusses negative values
- ✓ discusses unlimited positive values

- d) If 30 boxes were taken off the assembly line, determine the probability that exactly 13 were gigantic lengths.

<b>Solution</b>
$X \sim \text{Bin}(30, 0.427)$ $P(X = 13)$

<b>Specific behaviours</b>
<ul style="list-style-type: none"> <li>✓ states Binomial with parameters</li> <li>✓ uses <math>x=13</math></li> <li>✓ states prob (no need to round)</li> </ul>

- e) Determine the probability that it would take 20 boxes in a row off the assembly line before 8 gigantic boxes were found.

<b>Solution</b>
$X \sim \text{Bin}(19, 0.427)$ $P(X = 7) \times 0.427$

<b>Edit Action Interactive</b>


- Specific behaviours**
- ✓ states Binomial with  $n=19$
  - ✓ determines prob for  $x=7$
  - ✓ states total prob (no need to round)

Continued on next page

Q3 cont

If the costs of each box were determined as follows.

Box	short	long	Very long	gigantic
Cost \$	\$3.21	\$4.12	\$5.20	\$6.30

- i) Determine the mean cost to two decimal places. Show all working.

<b>Solution</b>
$3.21 \times 0.00043 + 4.12 \times 0.097 + 5.20 \times 0.476 + 6.30 \times 0.427 = 5.57$
<b>Specific behaviours</b>
<ul style="list-style-type: none"> <li>✓ multiplies each x score by prob</li> <li>✓ shows total series</li> <li>✓ states mean to 2 dp</li> </ul>

- ii) Determine the standard deviation to two decimal places. Show all working.

<b>Solution</b>
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