# 4.9 Normal distribution and calculations\_P\_2

**1a.** *[2 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

*X* ~ N(820, 2302)       ***(M1)***

**Note:** Award ***M1*** for an attempt to use normal distribution. Accept labelled normal graph.

⇒P(*X* > 1000) = 0.217       ***A1***

***[2 marks]***

**1b.** *[3 marks]*

## Markscheme

*Y* ~ B(24,0.217...)      ***(M1)***

**Note:** Award ***M1*** for recognition of binomial distribution with parameters.

P(*Y* ≤ 10) − P(*Y* ≤ 4)        ***(M1)***

**Note:** Award ***M1*** for an attempt to find P(5 ≤ *Y* ≤ 10) or P(*Y* ≤ 10) − P(*Y* ≤ 4).

= 0.613       ***A1***

***[3 marks]***

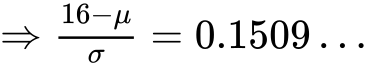
**2a.** *[6 marks]*

## Markscheme

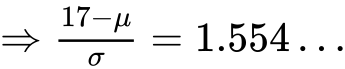
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use of inverse normal (implied by ±0.1509… or ±1.554…)       ***(M1)***

P(*X* < 16) = 0.56

      ***(A1)***

P(*X* < 17) = 0.94

      ***(A1)***

attempt to solve a pair of simultaneous equations       ***(M1)***

 = 15.9,   = 0.712      ***A1A1***

***[6 marks]***

**2b.** *[2 marks]*

## Markscheme

correctly shaded diagram or intent to find P(*X* ≥ 15)      ***(M1)***

= 0.895      ***A1***

**Note:** Accept answers rounding to 0.89 or 0.90. Award ***M1A0*** for the answer 0.9.

***[2 marks]***

**3a.** *[2 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

P(*L* ≥ 5) = 0.910      ***(M1)A1***

***[2 marks]***

**3b.** *[3 marks]*

## Markscheme

*X* is the number of wolves found to be at least 5 years old recognising binomial distribution      ***M1***

*X* ~ B(8, 0.910…)

P(*X* > 6) = 1 − P(*X* ≤ 6)      ***(M1)***

= 0.843       ***A1***

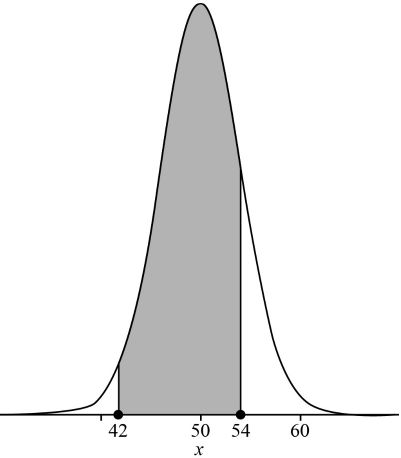
**Note:** Award ***M1A0*** for finding P(*X* ≥ 6).

***[3 marks]***

**4a.** *[2 marks]*

## Markscheme

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normal curve centred on 50      ***A1***

vertical lines at  = 42 and  = 54, with shading in between      ***A1***

***[2 marks]***

**4b.** *[2 marks]*

## Markscheme

P(42< *X* < 54) (= P(− 2< *Z* < 1))     ***(M1)***

= 0.819      ***A1***

***[2 marks]***

**4c.** *[2 marks]*

## Markscheme

P(*μ* − *k*σ < *X* < *μ* + *k*σ) = 0.5 ⇒ P(*X* < *μ* + *k*σ) = 0.75      ***(M1)***

*k* = 0.674      ***A1***

**Note:** Award ***M1A0*** for *k* = −0.674*.*

***[2 marks]***

**5.** *[6 marks]*

## Markscheme

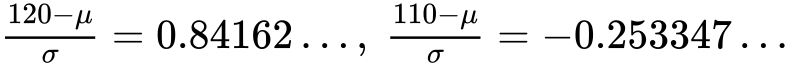
\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

let  be the random variable “amount of caffeine content in coffee”

     ***(M1)***



**Note:**     Award ***M1*** for at least one correct probability statement.

     ***(M1)(A1)(A1)***

**Note:**     Award ***M1*** for attempt to find at least one appropriate -value.



attempt to solve simultaneous equations     ***(M1)***

     ***A1***

***[6 marks]***

**6a.** *[2 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.



     ***(M1)A1***

***[2 marks]***

**6b.** *[2 marks]*

## Markscheme

     ***(M1)***

     ***A1***

***[2 marks]***

**6c.** *[4 marks]*

## Markscheme



     ***(M1)***

 or equivalent     ***(M1)(A1)***

     ***A1***

***[4 marks]***

**7a.** *[2 marks]*

## Markscheme

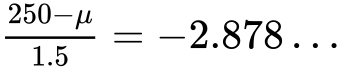
\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

     ***(M1)A1***

***[2 marks]***

**7b.** *[3 marks]*

## Markscheme

     ***(M1)(A1)***

     ***A1***

**Notes:**     Only award ***A1*** here if the correct 2dp answer is seen. Award ***M0*** for use of .

***[3 marks]***

**7c.** *[2 marks]*

## Markscheme

     ***(A1)***

     ***A1***

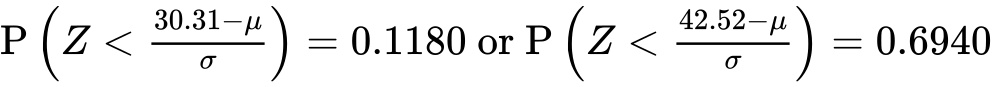
***[2 marks]***

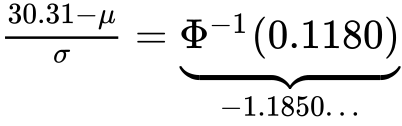
**8a.** *[6 marks]*

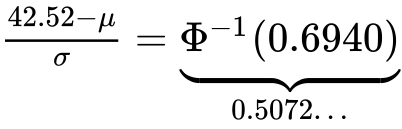
## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

    ***(M1)***

either      ***(M1)***

    ***(A1)***

    ***(A1)***

attempting to solve simultaneously     ***(M1)***

 and      ***A1***

***[6 marks]***

**8b.** *[2 marks]*

## Markscheme

 (or equivalent *eg*. )     ***(M1)***

    ***A1***

**Note:** Award ***(M1)A1*** for .

***[2 marks]***

**9.** *[6 marks]*

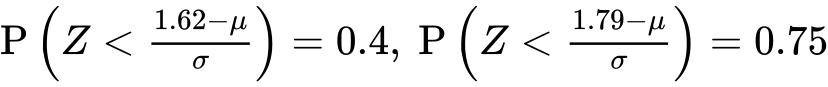
## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

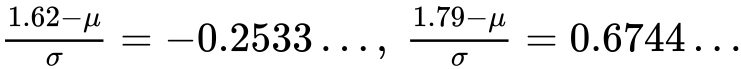
let the heights of the students be 

     ***M1***

**Note:** Award ***M1*** for either of the probabilities above.

     ***M1***

**Note:** Award ***M1*** for either of the expressions above.

     ***M1A1***

**Note:     *A1*** for both values correct.

     ***A1A1***

**Note:** Accept answers that round to 1.7 (m) and 0.18 (m).

**Note:** Accept answers in centimetres.

***[6 marks]***

**10a.** *[2 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

    ***(M1)A1***

***[2 marks]***

**10b.** *[3 marks]*

## Markscheme

**METHOD 1**

    ***(M1)***

    ***(A1)***

    ***A1***

**METHOD 2**

    ***(M1)***

    ***(A1)***

    ***A1***

***[3 marks]***

**10c.** *[2 marks]*

## Markscheme

    ***(M1)A1***

***[2 marks]***

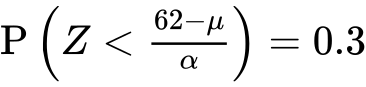
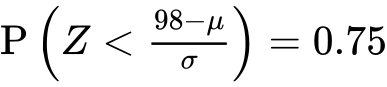
**11a.** *[6 marks]*

## Markscheme

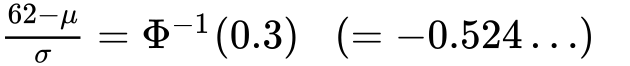
\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

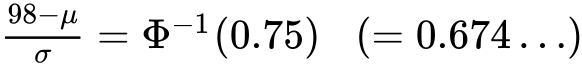
**Note:** In Section B, accept answers that correctly round to 2 sf.

(i)     let  be the weight of a worker and 

 and      ***(M1)***

**Note:** Award ***M1*** for a correctly shaded and labelled diagram.

and



or linear equivalents     ***A1A1***

**Note:** Condone equations containing the GDC inverse normal command.

(ii)     attempting to solve simultaneously     ***(M1)***

     ***A1A1***

***[6 marks]***

**11b.** *[1 mark]*

## Markscheme

**Note:** In Section B, accept answers that correctly round to 2 sf.

     ***A1***

***[1 mark]***

**11c.** *[2 marks]*

## Markscheme

**Note:** In Section B, accept answers that correctly round to 2 sf.

let  represent the number of workers over  kg in a lift of ten passengers

     ***(M1)***

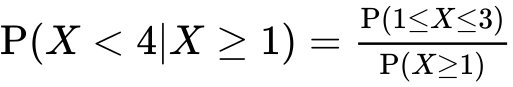
     ***A1***

***[2 marks]***

**11d.** *[3 marks]*

## Markscheme

**Note:** In Section B, accept answers that correctly round to 2 sf.

     ***M1(A1)***

**Note:** Award the ***M1*** for a clear indication of a conditional probability.

     ***A1***

***[3 marks]***

**11e.** *[3 marks]*

## Markscheme

**Note:** In Section B, accept answers that correctly round to 2 sf.

     ***(M1)***

     ***(M1)***

     ***A1***

***[3 marks]***

**11f.** *[3 marks]*

## Markscheme

**Note:** In Section B, accept answers that correctly round to 2 sf.

 workers require at least  elevators     ***(A1)***

     **(*M1)***

     ***A1***

***[3 marks]***

***Total [18 marks]***

**12a.** *[2 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.



     ***(M1)A1***

***[2 marks]***

**12b.** *[2 marks]*

## Markscheme

     ***(M1)A1***

***[2 marks]***

***Total [5 marks]***

**13a.** *[6 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

(i)          ***(M1)A1***

**Note:**     Accept 

**Note:**     Award ***M1A0*** for  ()

(ii)          ***M1***

expected number of turnips      ***A1***

**Note:**     Accept .

(iii)     no of turnips weighing more than  is      ***M1***

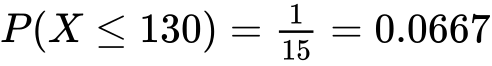
     ***A1***

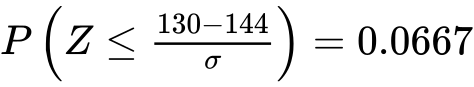
***[6 marks]***

**13b.** *[6 marks]*

## Markscheme

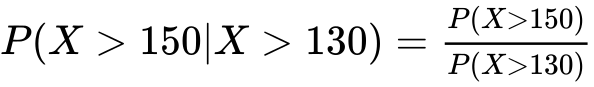
(i)     

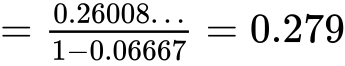
     ***(M1)***



     ***(A1)***

     ***A1***

(ii)          ***M1***

     ***A1***

expected number of turnips      ***A1***

***[6 marks]***

***Total [12 marks]***

**14a.** *[2 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

     ***(M1)***

     ***A1***

***[2 marks]***

**14b.** *[3 marks]*

## Markscheme

     ***(M1)(A1)***

     ***A1***

***[3 marks]***

***Total [5 marks]***

**15.** *[5 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.



     ***(M1)(A1)***

     ***(M1)***

     ***(A1)***

variance = 2630     ***A1***

**Notes:**     Accept use of  leading to variance = 2744.

***[5 marks]***

**16.** *[5 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

(a)     **METHOD 1**

     ***(M1)***

     ***A1***

finding *z* value for the upper quartile 

 or      ***M1***

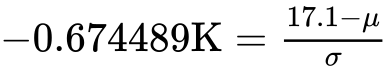
     ***A1***

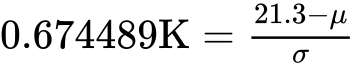
**METHOD 2**

finding *z* value for the upper quartile 

from symmetry the *z* value for a lower quartile is      ***M1***

forming two simultaneous equations:



     ***M1***

solving gives:

     ***A1***

     ***A1***

***[4 marks]***

(b)     using 

     ***A1***

**Note:**     Accept 18.4

***[1 mark]***

***Total [5 marks]***

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