| **Question** | **Scheme** | **Marks** |
| --- | --- | --- |
| **1(a)** | awrt + 1.40 | B1 |
|  (o.e) | M1A1ft |
|  (or awrt 16.0) | A1 |
|  |  |  **(4)** |
| **1(b)** | 0.4192 | B1 |
|  |  |  **(1)** |
|  |  | **(5 marks)** |
| **2(a)** |  | M1 |
| P(*Z* < -0.70) = 1 - 0.7580 | M1 |
| = 0.2420 **(awrt 0.242)** | A1 |
|  |  | **(3)** |
| **2(b)** | [P(*T* < *t* )=0.30 implies] *z* =  | M1 A1 |
|   | M1 |
| *t* = awrt 15.28 (allow awrt 15.28/9) | A1 |
|  |  | **(4)** |
|  |  | **(7 marks)** |
| **3(a)** |  | M1 |
|   | A1 |
|  = **awrt 0.309** | A1 |
|  |  | **(3)** |
| **3(b)** |  (Calc gives 1.036433...) | M1B1A1 |
|  ***d =* 14.5** (Calc gives 14.4727...) | A1 |
|  |  | **(4)** |
| **3(c)** | [P(*X* > *μ*  + 15 | *X* > *μ* – 15) = ] | M1 |
|  =  | A1 |
|  = or **awrt 0.538** | A1 |
|  |  | **(3)** |
|  |  | **(10 marks)** |
| **4(a)** |   | M1 A1 |
| *k* = *n* + 1 | A1 |
|  |  | **(3)** |
| **4(b)** |  | M1 A1 |
|  =  | A1cao |
|  |  |  **(3)** |
| **4(c)** |  | M1 |
|  = | A1cao |
|  |  | **(2)** |
| **4(d)** | Var (*X*) =  =  | M1 |
| Var (3*X*) = 9 Var (*X*) | M1 |
| = oe or 0.3375 or 0.338 | A1cso |
|  |  | **(3)** |
|  |  | **(11 marks)** |
| **5(a)** | 24 and 28 (above the mean)For 0.80 and 0.05 (clearly indicated)28240.050.80 | B1B1 |
|  |  | **(2)** |
| **5(b)** | 15%  | B1 |
|  |  | **(1)** |
| **5(c)** |  or  | M1 |
| 0.8416 and 1.6449 seen | B1 |
|  ,  | A1 A1 |
|  eliminating  or  | M1 |
|  **awrt** 4.98 | A1 |
|  **awrt** 19.8 | A1 |
|  |  | **(7)** |
| **5(d)** | *z =* | M1 |
|  = | dM1 |
| 1  0.9418 = 0.0582 **awrt** 0.06 | A1 |
|  |  | **(3)** |
|  |  | **(13 marks)** |
| **6(a)** | [Let *X* be the amount of beans in a tin. P(*X* < 200) = 0.1] |  |
|  [calc gives 1.28155156…] | M1 B1 |
|   = 209.996…. awrt 210 | A1 |
|  |  | **(3)** |
| **6(b)** | P(*X* > 225) =  | M1 |
| =  or 1 – P(*Z* < 1.92) (allow 1.93) | A1 |
| = 1 – 0.9726 = 0.0274 (or better) [calc gives 0.0272037…] |  |
| = 0.0274 |  |
|  = awrt **2.7%** allow **0.027** | A1 |
|  |  | **(3)** |
| **6(c)** | [Let *Y* be the new amount of beans in a tin] |  |
|  or  [calc gives 2.3263478…] | M1 B1 |
|   | dM1 |
|   (2.14933…) | A1 |
|  |  | **(4)** |
|  |  | **(10 marks)** |
| **7(a)** | The random variable *H* ~ height of females   [] | M1 |
|    | M1 |
|  = 0.1056 (calc 0.1056498…) **awrt 0.106** (accept 10.6%) | A1 |
|  |  | **(3)** |
| **7(b)** |  [] | M1 |
|  = 0.0062 (calc 0.006209…) awrt 0.0062 or  | A1 |
| [P( *H* >180| *H* >170)] =   | M1 |
|  = 0.0587 (calc 0.0587760…) **awrt 0.0587 or 0.0588** | A1 |
|  |  | **(4)** |
| **7(c)** | P(*H* > *h* |*H* >170) (= 0.5) or  | M1 |
| [P(*H* > *h*)] =  = 0.0528 (calc 0.0528249…) or [P(*H* < *h*)] = 0.9472 | A1ft |
|  (calc 1.6180592…) | M1 B1 |
| *h* = awrt 173 cm **awrt 173** | A1 |
|  |  |  **(5)** |
|  |  | **(12 marks)** |
| **8(a)** | P(*W <* 224) = P | M1 |
|  = P (*z* < -1.6) |  |
|  = 1 – 0.9452  | M1 |
|  = 0.0548 awrt 0.0548  | A1 |
|  |  | **(3)** |
| **8(b)** | 0.5 – 0.2 = 0.3 0.3 or 0.7 seen  | M1 |
|  0.5244 seen; any *z* | B1 M1 |
|  *w* = 234.622 awrt 235  | A1 |
|  |  | **(4)** |
| **8(c)** |   | M1 |
|   | M1 A1 |
|  |  | **(3)** |
|  |  | **(10 marks)** |
| **9** | N (0.2*n*, 0.16*n*) | Mean = 0.2*n* and Var = 0.16*n* oeThis may be awarded if they appear in the standardisation as 0.2*n* and either 0.16*n* or   | B1 |
| P= 0.0401 | Using a continuity correction either 55.5 or 54.5 | M1 |
| = 1.75 | B1: Using a *z* = awrt ± 1.75M1: Standardising using either 55.5, 54.5 or 55 and equal to a *z* value. Follow through their mean and variance. If they have not given the mean and Var earlier then they must be correct.A1: A correct equation. May be awarded for = 1.75 Condone use of inequality sign rather than equals sign.  | B1M1A1 |
| 0.2*n* + 0.7 – 55 = 0 | This is dependent on the previous method mark being awarded. Using either the quadratic formula or completing the square or factorising or any correct method to solve **their 3 equations**. If they write the formula written down then it must be correct for their equation. May be implied by correct answer of = 15 or 342.25**NB** you may award this mark if they use 54.5 for awrt 14.9, – 18.4, 221 or 33755 for awrt – 18.4, 223, or – 117If the answer is not one of these then the method for solving their 3 term equation must be seen.  |  |
|  = 15 | Allow 15 or – 18.5 do not need to see *n*  or  Condone *n* = 15 or *n* = – 18.5 | A1 |
| *n* = 225 | Cao 225 do not need to see see *n*  or  | A1 |
|  |  | **(8 marks)** |
|  | Alternative method for last 3 marks(0.2*n* – 55)2 = (– 0.7)20.04 *n*2 – 22.69*n* + 3080.25 = 0*n* = 225 or 1369/4*n* = 225 | M1 solving 3 term quadratic in *n* as above A1 either 225 or 1369/4 or 342.25A1 must select 225 |  |
| **10(a)** | P(*M* < 10) = P = 0.1 |  |
| ⇒ =, – 1.2816 | M1B1 |
|   | A1 |
|  |  | **(3)** |
| **10(b)** | *T* represents number less than 12 minutes. *T* ~ B(15, 0.1) | B1 |
|  P(*T* ≤ 1)  | M1 |
|  = 0.549  | A1 |
|  |  | **(3)** |
| **10(c)** | [ *T* ~ number of people who take less than 12 mins to complete the test]*T*~ B(*n*, 0.1) |  |
| *T* can be approximated by N( 0.1*n*, 0.09*n*) | B1 |
|  = 0.3085 | M1 |
|  or $\frac{8.5-0.1x^{2}}{0.3x}=-0.5$ | B1 |
| M1 |
| A1 |
|    | M1A1 |
|  *n* = 100 | A1cso |
|  |  | **(8)** |
|  |  | **(14 marks)** |

|  |  |  |  |  |  |
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|  | **Source paper** | **Question number** | **New spec references** | **Question description** | **New AOs** |
| 1 | S1 2011 | 2 | A 4.2 | Normal distribution | 1.1b, 3.1a |
| 2 | S1 2011 | 4 | A 4.2 | Normal distribution | 1.1b, 3.3, 3.4 |
| 3 | S1 2013R | 4 | A 3.2, 4.2 | Normal distribution, Conditional probability | 1.1b, 3.1a, 3.1b, 3.4 |
| 4 | S1 2015 | 6 | A 3.2, 4.2 | Normal distribution | 1.1b, 2.1, 3.1a, 3.4 |
| 5 | S1 2014R | 6 | A 4.2 | Normal distribution | 1.1b, 3.1b, 3.4 |
| 6 | S1 2013 | 6 | A 4.3 | Normal distribution | 1.1b, 2.1, 3.1b, 3.4 |
| 7 | S1 2014 | 7 | A 3.2, 4.2 | Normal distribution | 1.1b, 2.1, 3.1b, 3.3, 3.4 |
| 8 | S1 Jan 2012 | 7 | A 4.2 | Normal distribution, Probability | 1.1b, 3.1b, 3.3, 3.4 |
| 9 | S2 2016 | 5 | A 4.2 | Binomial distribution, Normal distribution | 1.1b, 1.2, 3.1b, 3.3, 3.4 |
| 10 | S2 2017 | 5 | A 4.1, 4.2 | Binomial distribution, Normal distribution | 1.1b, 3.1b, 3.3, 3.4 |