|  |
| --- |
| Guidance on the use of codes for this mark scheme |
| M | Method mark |
| A | Accuracy mark |
| B | Working mark |
| C | Communication mark |
| P | Proof, process or justification mark |
| cao | Correct answer only |
| oe | Or equivalent |
| ft | Follow through |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Question**  | **Working** | **Answer** | **Mark** | **AO** | **Notes**  | **Grade** |
| **1 a** **b** **c** **d** | 1 : 6 ≠ 6 : 1because 1 : 6 = 6 : 36 (×6)Or 6:1 = 1:  (÷6)19 : 95 = 1 × 19 : 5 × 19= 1 : 5B: G2 : 54 : 106 : 15 (21 students)7 : 17.5 (not possible)8 : 20 (28 students) | No19 : 95 (÷19)1 : 5No, because the units must be the same in order to compareNo, to retain this ratio requires 2 boys and 5 girls each time, so 7 students. This means that there can only be multiples of 7 students in the club. 24 is not a multiple of 7. | P1B1C1C1 | 2 |  P1 for demonstrating an understanding of each ratio in its unitary form as a method of comparison, oeB1 for calculation showing cancellingC1 for an understanding of scale and equivalence of unitsC1 for reference to multiples of 7 | B |
| **4** |
| **2 a** **b**  | Packs of 3:90 ÷ 3 = 3030 packs cost 30 × £1.50 = £45Packs of 15:90 ÷ 15 = 66 packs cost 6 × £5= £30Packs of 25: Not possible, because 90 is not divisible by 25.Buy 2 get one free on packs of 15.Buy two packs of 15 for £10Get a pack of 15 free.45 will cost £20.So new cost = £20Or (3 × 15) + (3 × 15) = 90 £10 + £10 = £20 | 6 packs of 15.6 packs of 15 for £30.No, still buy 6 packs of 15 but now for the lower price of £20. | B1A1B1C1 | 2 | B1 for correct combination to 90A1 for correct costB1 for a method for calculating of the costC1 for correct justification of choice | B |
| **4** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **3 a** **b** | Appropriate workings related to their question. | For example:Easy: a shop increased its prices by 10%. If an item costs £100, how much more does it costs after the price increase? £10Easy to find because original amount is £100.Difficult: A worker’s hourly rate increased by 25%. If the hourly rate was £8 before the increase, how much does the worker get paid per hour after the increase? **£10**Difficult to find because the percentage is not a multiple of 10 and context is more complex. | C1C1C1C1 | 23 | C1 for clarity of questionC1 for explanation that links complexity of mathematics to context of questionC1 for clarity of questionC1 for explanation that links complexity of mathematics to context of question | B |
| **4** |
| **4**  |  | The formula for density is: density = mass ÷ volume If the objects have the same volume but different masses, this formula indicates that the densities will be different and so suggests the objects are made from different metals.  | C1 | 3 | C1 for insight into the effect of changing a variable in a formula | M |
| **1** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **5 a** **b** | 1 g/cm3 = 1000 kg/m3So 2.3 g/cm3 = 2300 kg/m3 Use the formula: density = Rearrange the formula:volume = mass ÷ density1 tonne = 1000 kgso volume = kg 2.7 g/cm3 = 2700 kg/m3 They both have the same volume. Again, use the formula: mass = density × volume13 × 2700 = 35 100The granite has a mass of 35.1 tonnes and the sandstone has a mass of 30 tonnesOR =1.17  | = 13 m3 to nearest m35.1 tonnes heavier or 17% heavier. | P1B1A1B1M1C1 | 23 | P1 for conversion from g/cm3 to kg/m3 B1 for correct rearrangement of formula A1 oeB1 for calculating correct tonnage for graniteM1 for correct method for comparison of massC1 for stating correct comparison | M |
| **6** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **6** | p0 = 630 kg/m3 pm = 550 kg/m3 m0 = 315 g = 0.315 kgStart with the formula: p = Rearrange to: v =The carvings are identical so the volume is the same. Rearranging:m*m* = 550 × = 0.275 kg | Mass = 275 g or 0.275 kg | M1B1A1 | 3 |  M1 for dividing mass by volume and making correct comparisonB1 for rearranging A1 oe | M |
| **3** |
| **7 a** **b** **c** | The ratio men : women is 5 : 2.There are 24 women so the total membership is:5 × 12 : 2 × 12 The ratio becomes 60 : 24Then the total membership = 60 + 24 = 84 The ratio R : S : J is 2 : 3 : 5.There are 10 shares.£85 ÷ 10 = £8.50 Shaun pays 3 × £8.50 = £25.50  | 84 £25.50Own question like the one in part a. For example: In a tennis club, 30 members are men. The ratio of women to men is 6 : 5. How many of the members are female? **36** | M1A1M1A1C1 | 3 |  M1 for multiplying by 12 oeA1 for 84 members in totalM1 for division of 85 by 10A1 for correct multiplication 3 × £8.50 oeC1 for correct type of question | M |
| **5** |
| **8 a** **b** **c** |  b2 =  × b1b2 =  × 8= = 10 hoursb2 costs £198b1 costs £118= 1.68 to 2dp= 1.25 = b2 = = Reduction is:£198 – £147.50 = £50.50 | 10 hours The increase in cost is proportionally more than the increase in battery life.She would need a reduction of £50.50.  | P1A1B1C1M1A1 | 3 | P1 for process of setting up equationA1 caoB1 for division of higher cost by lower costC1 for use of comparison to justify the answerM1 for multiplying lower cost by 5 and dividing by 4A1 cao | M |
| **6** |
| **9 a** **b** | For the first 5-pack:5 × 90 minutes = 450 minutes £6.60 = 660p650p ÷ 450 = 1.44p per minuteFor the 10-pack:10 × 80 = 800 minutes for £6.50 ÷ 800 = 0.8125p per minute cheapestFor the second 5-pack:5 × 80 = 400 minutes£4.00 = 400p400p ÷ 400 = 1p per minuteOr450 ÷ 6.50 = 69 minutes per £1800 ÷ 6.50 = 123 minutes per £1 best value400 ÷ 4.00 = 100 minutes per £1 | The best buy is the 10-pack of 80 minutes each @ £6.50.There are more CDs than are needed.A recording time of 80 minutes is not long enough.£6.50 is too expensive at time of purchase (prefer just to spend £4). | P1B2C1 | 3 | P1 for process of multiplying up for total minutes and then division to identify either cost per minute or time per £B2 for correct workings in each of the three casesC1 for explanation of possible reasons not to choose the best buy | M |
| **4** |
| **10**  | £800 × 1.19 gives €952£800 × 1.22 gives €976€976 – €952 = €24  | They will get €24 more. | M1B1A1 | 2 | M1 for multiplicationsB1 for subtraction ftA1 cao | M |
| **3** |
| **11 a i**  **ii**  **iii** **b** | By expressing this as: ‘How many….. in ….’Use chosen method from part a to explain correctly how to divide, using fractions. |  | C2C1C1C1P1 | 2 | C1 for correct justification C1 for showing diagram oeC1 for correct justification showing diagram oe1 for correct justification showing diagram oeC1 for correct explanation P1 for process showing that dividing by doubles the number of pieces, so is the same as multiplying by 2 | M |
| **6** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **12 a****b** | 8 kg = 8000 g8000 ÷ 250 = 32 3 kg = 3000 g3000 ÷ 85 = 35 (to nearest whole number) 2 kg = 2000 g2000 ÷ 20 = 1007 kg = 7000 g7000 ÷ 250 = 28So the limiting value is the amount of icing sugar. Therefore she can make 24 × 28 = 672 biscuits.672 ÷ 15 = 44.844 ×  = 3333 × £2.99 = £98.6744 – 33 = 11 discounted £2.99 × 0.85 = £2.54 to 2 dp11 × 2.54 = £27.94Total sales = £98.67 + £27.94 = £126.61Total costs = £59 + £26 = £85To calculate percentage profit:profit =  = 0.489 529 412 and percentage profit = 0.489 529 412 × 100% = 48.95% | She can make 44 complete packs of 15 biscuits.49% profit to the nearest integer. | P1B1P1B1M1A1M1A1 | 23 | P1 for process of division to see how many batches of 15 biscuits can be made with each ingredientB1 for 32, 35, 100 and 28P1 for correct identification of limiting value B1 for correct cost of  of biscuitsM1 for use of 0.85 multiplierA1 for caoM1 for division of total sales by total cost (ft)A1 for correct percentage with rounding | M |
| **8** |
| **13**  | Price including VAT = £595 × 1.20 = £714With a 20% discount: £714 × 0.8 = £571.20£571.20 – £595 = £23.80OR£595 × 0.8 = £476£476 × 1.2 = £571.20 |  He is overpaying by £23.80Disagree. He would pay the shop more than he needs to.  | P1M1B1C1 | 2 | P1 for process of multiplying by 1.2 to find cost with VATM1 for multiplying by 0.8 to find 20% reduced price (ft)B1 for subtracting to find overpaymentC1 for demonstrating overpayment with explanation | M |
| **4** |
| **14 a**  **b** **c**  **d**  |  | With a reduction of 15%, the sale price (*B*) is A × 0.85.A = Yes, the new value will always be the original value multiplied by a percentage, calculated from the percentage change. For a reduction, the multiplier is (100 – the percentage reduction)%, for an increase it is (100 + the percentage increase)%.Percentage change problem, for example: The cost of a new car was £*A*.In the new financial year, it increased by 5% to £B. Write a formula to describe the proportional change.B = A × 1.05 and A = .  | M1P1C1C1 | 2 | M1 for correct formulaP1 for correct rearrangement of ÷ by 0.85C1 for clear explanationC1 for clarity of communication of question | M |
| **4** |
| **15 a**  **b**  **c**  | A × 1.5 × 1.5 = A × 1.52= A × 2.2580% discount gives a price of A × 0.20.60% followed by 20% gives a price ofA × 0.4 × 0.8 = A × 0.32.A × 0.75 × 1.20 = 0.9AA × 1.20 × 0.75 =0.9A | No, an increase to *A* of 50% followed by another increase of 50% gives 2.25*A*.Doubling would give 2*A* and 2*A* ≠ 2.25*A*.An 80% discount off the price of A gives a new price of 0.2A.A 60% discount off the price of A, followed by a further 20% discount, gives a new price of 0.32A so the 80% discount is better value.If the original cost is A, the cost after a discount of 25% is 0.75A and paying VAT at 20% gives a new price of 0.9A.If VAT is added first, the price is 1.2A. A 25% reduction gives a new price of 0.9A.Because multiplication is commutative, the final prices are the same. It makes no difference. | C1P1C1 | 2 | C1 for clear explanation with calculated justification oeP1 for clear explanation with calculated justification oeC1 for clear explanation with calculated justification oe | M |
| **3** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **16 a**  **b** **c** **d** **e**  | *A* ×= £996*A* = £996 ×  = £1162*A* × 1.04 = £6.50*A* =  = £6.25*A* × 1.07 = £957.65*A* = £= £895If the original amount is A, the multiplier is b for a percentage increase or decrease, and the new value is C:A × b = C |  £1162 £6.25£895*A* = *C* ×  If the multiplier is x:x > 1 means an increase0 < x < 1 means a decrease. | M1A1M1A1M1A1C1C1 | 23 | M1 for multiplication A1 caoM1 for multiplication by 1.04 and rearrangementA1 caoM1 for multiplication by 1.07 and rearrangementA1 caoC1 for correct explanation either in words or by a general formula, provided the variables are definedC1 for clarity that a decrease has a multiplier between 0 and 1 and increase has a multiplier greater than 1 (a multiplier of 1 will not change the value) | M |
| **8** |
| **17 a** **b** | Comparing salary in May and April: £1568 – £1544 = £24Comparing sales in May and April:£24 is earned on £4000 sales.24 000 ÷ 4000 = 66 × £24 = £144£1544 – £144 = £1400So the basic salary is £1400.£1553 – £1400 = £153== 6.3756.375 × 4000 = £25 500Own question  | £25 500Own question | B1C1B1B1C1 | 3 | B1 for subtraction of April salary from May salaryC1 for clearly comparing the salary difference with the sales differenceB1 for division and multiplication to establish basic salary (ft)B1 for correct calculations to find sales figure (ft)C1 for clear question with reasoning and solution | M |
| **5** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **18**  | Number on Saturday = 2 × number on Friday S × 1.5 = (2F) × 1.5S =  = 2*F* | There are still twice as many visitors on Saturday as on Friday. There are 100% more visitors on Saturday compared to Friday. | C1 | 3 | C1 for an explanation that includes an appreciation that the two sets of visitors increase proportionally and that the original proportion therefore does not change oe | M |
| **1** |
| 1. **a**

 **b** | Number of workers = WNumber of days = tK = constantW = 2 =  so k = 40W = With 3 workers:3= t = = 13 daysThis is Thursday of week 3. | They would finish after 13days.They would probably get in each other’s way and would not be able to complete the job in a very short time.Some jobs have to wait until others are finished, for example, they can’t paint until the walls have been plastered. | M1B1C1 | 3 | M1 for finding constant of proportionalityB1 for division of 40 by 3 and relating this to number of days workedC1 for an appropriate reason oe | M |
| **3** |
|  |  | Current costs are £1.50 per mile and 20p per minute.Competitive pricing structure: answers will vary.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Time taken | 2 min | 5 min | 10 min | 12 min | 15 min |
| Distance | 1 mile | 2 miles | 3 miles | 5 miles | 6 miles |
| Total charge(A) | £2.50 | £4.00 | £6.50 | £9.90 | £12.00 |
| Total charge (B) | £1.90 | £4.00 | £6.50 | £9.90 | £21 |

 | P1B1B1 | 23 | P1 for process of finding chargesB1 for working out current price structureB1 for correct calculation of a pricing structure that has an element of competitionThe suggestion (B) competes for short distances, matches for mid distances and is not competitive for longer journeys. | M |
| **3** |
| **21 a**  **b** **c**  **d** |  | Travel 30 miles in 45 minutes.45 minutes = hour=  = = 40 mph as required Not changing minutes into hours.Units of speed = Own easy and difficult examples  | C1C1C1C1B2 | 2 | C1 for correct explanation with calculation that indicates 10 miles every 15 minutes implies 40 miles every 60 minutes oeC1 for clear explanationC1 for stating a common misconceptionC1 for correctly stating the relationship between speed, distance and timeB1 for one easy and one difficult example with justificationB1 for multiple different examples | M |
| **6** |
| **22** | A rectangle 1 m × 2 mArea = 2 m2A rectangle 4 m × 8 mArea = 32 m2Length scale factor = 4Area scale factor = 16 (42) | 32 m2 | P1A1 | 23 | P1 for process of trial and improvementA1 cao | M |
| **1** |
| **23**  | 75 ÷ 30 = 2.5Length scale factor is 2.5Volume scale factor is(2.5)3 = 15.6255000 × 15.625= 78,125 cm3 = 78.125 litres | 78.125 litres | B1M1A1 | 23 | B1 for calculation of length scale factorM1 for calculation of volume scale factorA1 cao | M |
| **3** |
| **24**  | Length scale factor = 450 ÷ 15 = 30Volume scale factor = 303 = 27 000450 × 27 000 = 12 150 000 cm3(÷ 1003 for m3 )= 12.15 m3  | 12.15 m3 | B1M1M1A1 | 3 | B1 for calculation of length scale factorM1 for calculation of volume scale factorM1 for correct conversion to cubic metresA1 cao | M |
| **4** |
| **25**  | Length scale factor = 18 ÷ 12 = 1.5Volume scale factor = (1.5)3Volume of paint in big tin = 800 ml × (1.5)3 = 2700 ml2700 ÷ 800 = 3.375So he can fill 3 tins. | 3 small tins can be filled from one large tin.  | B1M1A1 | 2 | B1 for calculation of length scale factorM1 for calculation of volume scale factorA1 cao | M |
| **3** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **26 a**  **b** | New area is (a × 1.15)2 = a2 × 1.152= 1.3225a2Percentage increase = (1.3225 – 1) × 100%Area = a × 1.15 × b × 0.95 = ab × 1.15 × 0.95 = 1.0925abPercentage increase (1.0925 – 1) × 100% | Area increases by 32.25%.Area increases by 9.25%.  | M1A1M1A1 | 2 | M1 for use of correct multiplier showing 15% increaseA1 caoM1 for use of correct multiplier showing 15% length increase and 5% width decreaseA1 cao | M |
| **4** |
| **27 a** **b** **c** **d**  |

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **C** |
| 5 | **4** | 17 |
| 4 | 3.2 | 13.6 |
| 2 | 1.6 | **6.8** |
| 8 | 6.4 | 27.2 |
| 12 | 9.6 | 40.8 |
| 6.8 | 5.44 | 23.12 |
| 2.8 | 2.24 | 9.52 |

= = 0.8= = 3.4 This also means that == 4.25 So yes there is enough information.13 itemse.g.

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **C** |
| ● |  |  |
|  | ● | ● |
|  | ● | ● |
|  | ● | ● |
|  | ● | ● |
|  | ● | ● |
|  | ● | ● |

One variable is isolated from the other two.9 items e.g.

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **C** |
| ● |  | ● |
|  | ● | ● |
|  |  | ● |
|  |  | ● |
|  |  | ● |
|  |  | ● |
|  |  | ● |

There should be at least one value in each row and two rows should have at least two pairs linking a different pair.Always start in a row where at least 2 quantities are given, to work out the third quantity, so that relationships between all three are known. Then use these to work out other quantities.In this example there are 2 possible starting points. | Yes, there is sufficient information. | C1C1C1C1C1 | 2 | C1 if all three ratios are shown as part of the explanation and justification of answerC1 for clear explanation of as many values entered as possible such that one variable remains isolated from the other two oeC1 for clear explanation that there should be at least one value in each row and two rows should have at least two values linking a different pair of A, B, C oeC1 for clear explanationC1 for explanation of the best starting point and stating how many different starting points there are | M |
| **5** |
| **28**  | In year 1:£8000 × 0.027 = £216Interest = £216Less 20% tax:£216 × 0.8 = £172.80So the total at end of year 1 = £8000 + £172.80=£8172.80In year 2:£8172.80 × 0.027 = £220.67Interest = £220.67Less 20% tax:£220.67 × 0.8= £176.54At end of year 2 :Amount = £8172.80 + £176.54 = £8349.34 | No, Sam is incorrect.She will have £8349.34See workings as explanation. | P1B1B1C1 | 2 | P1 for use of correct multipliersB1 for multistep calculation for year 1B1 for multistep calculation for Year 2 (ft)C1 for clarity of explanation through setting out of calculations | M |
| **4** |
| **29** | B × 0.8*n*<Divide both sides by B.0.8*n*< 0.83 = 0.5120.84 = 0.4096OR£100 × 0.8 =£80£80 × 0.8 = £64£64 × 0.8 = £51.20£51.20 × 0.8 = £40.96 | 4 weeks  | P1M1P1A1 | 2 | P1 for choosing a starting a position, either a variable such as *B* or a specific amount such as £100M1 for working through the weeks in some wayP1 for the process of finding amounts for weeks 3 and 4 to show the point at which the bank account first dips below 50% of the original balancecao | H |
| **4** |
| **30** |  | 1. graph d
2. graph e
3. graph b
4. graph c
5. graph f
6. graph a
 | B6 | 2 | B1 for each correctly identified graph with reference to why, for example:f(x) ∝ x2 is graph d as points are (–2, 4), (–1, 1), (0, 0), (1, 1), (2, 4) and it is a parabolaf(x) = 2x , x >0 f(x) = –2x , x < 0 is graph e as it is linear and has no negative f(x) values; the gradient is 2 and –2 | H |
| **6** |
| **31 a** **b** **c** | y = xy = k where k is the constant of proportionality  | Inverse proportion describes the relationship between two variables such that as one increases the other decreases.xy = kor y = Own problem, for example: It takes 5 men 10 days to dig a hole. The number of men, y, is inversely proportional to the number of days, x. How long would it take for ten men to dig the same hole? (5 days) | C1M1C1 | 2 | C1 for clear explanation of inverse proportionM1 for correct equationC1 for clear question | H |
| **3** |
| **32 a** **b** **c**  | r = 6 × 103 mF*1* ∝  = F*2* ∝  =  = 0.996 | Fg = 0.996 to 3 dp The difference is too small (reference part b). | M1B1A1C1 | 2 | M1 for correct functionB1 for calculation of F1 and F2A1 caoC1 for correct interpretation of a scale factor close to 1 | H |
| **4** |
| **33**  |  | The speed of the faster car is 40 mph.T = = So they meet after 30 minutes.Speeds are in the ratio 1 : 2 = 20 : 40 = 10 : 20So the cars meet when the slower car has travelled 10 miles and the faster car has travelled 20 miles. It will take half an hour for a car travelling at 20 mph to go a distance of 10 miles. | M1C1A1 | 2 | M1 for recognising and using the ratio of the speedsC1 for clarity of reasoning and explanation, diagram oeA1 cao | H |
| **3** |
| **34**  | 4y = 2x2y = gradient =   = = = 3 | 3 | M1A1 | 2 | M1 for rearranging and substituting given values of xA1 cao | H |
| **2** |
| **35** |  | ==As above. | M1C1 | 2 | M1 for appropriate substitution to enable comparison with Q35C1 for showing that the two functions give the same answer | H |
| **2** |
| **36 a** **b** | f*(*x*) =* mx +cThe gradient =  *=*  *=* mf*(*x*) =* at x *= 2*The gradient =  *=* *(*2x *+* h*)* h*→ 0* *=* *(*2x*) =* xAt x= 2, gradient = 2.From the graph, points on the tangent are (1, 0) and (2, 2).The gradient = = 2 | As workingAs working | A1P1A1P1M1 | 2 | A1 for clarity of proofP1 for accuracy with manipulation of functionA1 for clear reasoningP1 for accuracy with manipulation of function to show a gradient of 2M1 for gradient from points on the straight line | H |
| **5** |
| **37 a** **b** | £28 000 × 1.053 = £32 413.50£14 500 × 1.05*n*> £ 20 000 = 1.4Try n = 7 years.£14 500 × 1.057 = £20 402.96 | £32 413.507 years | B1M1A1 | 2 | B1 for identification and use of multiplierM1 for trial and improvement or reasoning to try 7 yearsA1 cao | H |
| **3** |
| **38**  | Sycamore:4 × 1.0811 = 9.3274 × 1.0812 = 10.073Conifer:2 × 1.1511 = 9.3052 × 1.1512 = 10.7 | 12 yearsAfter 11 years, the sycamore is 9.326 m tall and the conifer is 9.305 m tall. After 12 years, the sycamore is 10.073 m tall and the conifer is 10.7 m tall. | M1B1P1 | 2 | M1 for correct calculation method to find heights of treesB1 for clarity of final reasoningP1 for finding all four heights after 11 and 12 years | H |
| **3** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **39 a** **b** **c**  | A × 1.04*n*= 2ADivide both sides by A.1.04*n*≥ 21.0410 = 1.48 (2 dp)1.0415 = 1.80 (2 dp)1.0420 = 2.19 (2 dp)1.0417 = 1.95 (2 dp)1.0418 = 2.03 (2 dp)0.6*n*= 0.10.62 = 0.360.65 = 0.077 760.64 = 0.1296 | 18 years 4 bounces Own problem | M1A1M1A1C1 | 2 | M1 for appropriate iterations to find 2*A*A1 caoM1 for appropriate iterations to find number of bouncesA1 caoC1 for clarity, relevance and accuracy of own question | H |
| **5** |
| **40 a** **b** | *f*(x) *=* a*(*b*)x*Day Number of bacteria1. 1
2. 2
3. 4
4. 8
5. 16
6. 32
7. 64 = 26
 | 26 = 64The population doubles each day.a and b are constants.a is the starting size of the population and so doesn’t change.b is the multiplier (by how much the population grows each day) and the value of this doesn’t change.x is a variable as it represents the changing number of days. | M1A1C3 | 2 | M1 for correct iterationsA1 caoC3: one mark for each explanation of a, b and x | H |
| **5** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **41** **i** **ii** **iii** |  | F(x) = a(b)*x*b < 1 the population decreases.b = 1 the population stays the same.b > 1 the population increases. | C3 | 2 | C1 for each correct explanation of the impact on the population as b varies | H |
| **3** |
| **42 a** **b** | Epidemic started by a single carrier so *x*0 = 1.Considering infection after 10 days so*t* = 10. | x*n* + 1 = *Rt*x0 x10 = *R*10Newspaper headline to engage readers with the story of this epidemic e.g. how long before x people are infected.  | M1A1C1 | 2 | M1 for correct interpretation of , and use of, the iterative formulaA1 for caoC1 for relevant , informative headline | H |
| **3** |
| **43** |  | 0.43 bar | M1A1 | 2 | M1 for correct use of formulaA1 cao | H |
| **2** |
| **44 a** **b** | x *=* 1 +  x(x – 3) = x – 3 + 11x*2 –* 3x *=* x + 8x*2 –* 4x – 8 *=* 0if x1= 5x*2*= 1 +  = 1 +  = 6.5x3 = 1 +  = 4.14286… | Show that… as workings.x = –1.46 to 2 dp | M1C1M1B1A1 | 3 | M1 for algebraic manipulationC1 for clarity of justificationM1 for correct use of iterationB1 for substitutionsA1 for one root found (no credit if both roots are found)Using x = 5 as the first iteration, after 19 iterations you arrive at x = –1.46 to 2 dpLikewise, if the first trial is –1, 11 iterations lead to the solution x *= –*1.46 to 2 dp. | H |
| **5** |