

Mark Scheme for June 2011

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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Question	Expected Answers	Marks	Additional Guidance
In ALL questions	<p>CREDIT AW FOR ALL i.e. credit any alternatively worded statement that conveys the same sense as the mark point. If a particular word is essential and no other will do it is underlined.</p> <p>IGNORE wrong or vague statements unless they directly contradict a mark point. e.g. in Q1(a)(i) mark point 1: Therefore penalise <i>“plants eat sheep”</i> (CON) but ignore <i>‘sheep absorb plants by phagocytosis’</i> (wrong) or <i>‘sheep make use of plants’</i> (vague).</p> <p>ACCEPT incorrect spellings if they are recognisable and sound the same when pronounced, even for underlined terms.</p>		

Question	Expected Answers	Marks	Additional Guidance
1 (a) (i)	<p>1 (sheep / animals) ingest / consume / eat / feed on (grass / plants) ;</p> <p>2 digest / hydrolyse , (protein) to amino acids ;</p> <p>3 amino acids move into , blood / cells ;</p> <p>4 synthesis of <u>proteins</u> / <u>translation</u> ;</p>	3 max	<p>2 ACCEPT break down IGNORE enzymes</p> <p>3 ACCEPT amino acids are absorbed into , blood / cells CREDIT AW description of movement e.g. diffusion / active transport but DO NOT CREDIT movement by osmosis</p>
1 (a) (ii)	<p>1 death / leaf loss ;</p> <p>2 decomposition / decay ;</p> <p>3 excretion / urination / described ;</p> <p>4 egestion / defaecation / described ;</p>	2 max	<p>3 IGNORE faeces in the context of mp3 but do not then credit mp4 as a description therefore <i>‘excretion of faeces’</i> scores mp3 only IGNORE waste matter</p> <p>4 IGNORE waste matter</p>

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(iii)	<p>1 C is <i>Nitrosomonas</i> ;</p> <p>2 D is <i>Nitrobacter</i> ;</p> <p>3 C and D are <u>nitrifying</u> bacteria ; for mps 1 , 2 and 3 internal max 2</p> <p>4 plants need nitrates to make , amino acids / protein(s) / enzymes / DNA / RNA / nucleic acids / chlorophyll / cytoplasm / new cells ;</p>	3	<p>Full marks can only be awarded if mp 4 awarded</p> <p>1 & 2 ACCEPT <i>“they are ‘<u>Nitrosomonas</u> and <u>Nitrobacter</u>’ = 2 marks</i> (correct order)</p> <p><i>‘they are <u>Nitrobacter</u> and <u>Nitrosomonas</u>’ = 1 mark</i> (wrong order)</p> <p>4 IGNORE plants need nitrates to grow (as given in Q)</p>
1	(a)	(iv)	<p>1 E continues / plants use nitrate ;</p> <p>2 less / no , B / decay ;</p> <p>3 less / no , C / D / recycling of nitrogen / nitrification ;</p> <p>4 (cabbages) harvested / removed ;</p>	3 max	<p>IGNORE references to other letters throughout</p> <p>2 ACCEPT cabbages do not rot down</p>

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(v)	<p>1 legume / any named leguminous plant ;</p> <p>2 <i>Rhizobium</i> / nitrogen-fixing bacteria (in root nodules) ;</p> <p>3 <i>idea of converting</i> nitrogen gas / N₂ , into , compounds / ammonium / ammonia / amino acids / protein (in plants) ;</p> <p>4 plants ploughed in / plants left to decay / ref B / ref C / ref D ;</p>	3 max	<p>1 CREDIT English or Latin name. Examples include but are not limited to: pea (<i>Pisum</i>) / bean (<i>Phaseolus</i> or <i>Vicia</i>) / vetch (<i>Vicia</i>) / soya (<i>Glycine</i>) / chickpea (<i>Cicer</i>) / peanut (<i>Arachis</i>) / alfalfa, lucerne or medick (<i>Medicago</i>) / clover or trefoil (<i>Trifolium</i>) / lupin (<i>Lupinus</i>) / <i>Leucaena</i> / <i>Cyamopsis</i> / <i>Sesbania</i> IGNORE names of non-leguminous plants, therefore <i>'plant legumes such as cucumbers'</i> scores mp 1</p> <p>3 the nitrogen must be clearly gaseous IGNORE nitrite / nitrate (because not made in plant)</p>
1	(b)		<p>1 genetic resource / gene bank / have (different) alleles ;</p> <p>2 for , genetic engineering / genetic modification / artificial selection / selective breeding / described ;</p> <p>3 if conditions change / in the future ;</p> <p>4 example of useful trait ;</p> <p>5 to <u>maintain</u> , biodiversity / genetic diversity / (large) gene pool ;</p>	2 max	<p>IGNORE biotourism</p> <p>1 IGNORE source of genes</p> <p>3 IGNORE unless context is genetic</p> <p>4 e.g. disease resistance (not immunity) / hardiness / more or better quality wool or meat An animal need not be named but if it is it should be a farm animal e.g. sheep / cows / goats / pigs / poultry</p> <p>5 CREDIT ORA to prevent loss of genetic diversity IGNORE to prevent extinction / to increase biodiversity</p>

Question			Expected Answers	Marks	Additional Guidance
1	(c)	(i)	mutation / described ; <u>selection</u> / <u>selection</u> pressure / <u>selective</u> advantage ;	2	1 ACCEPT new or different allele formed / DNA changed 2 IGNORE type of selection
1	(c)	(ii)	1 small , population / gene pool ; 2 ref. inbreeding / genetic drift ; 3 unusual diet / cannot eat grass / poisoned by grass / must eat seaweed ; 4 may not be commercially viable / expensive to keep ;	2 max	1 CREDIT lack of genetic , variability / variety 2 CREDIT founder effect 3 Mark point must relate to diet
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Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	<p>1 <u>instinctive</u> ;</p> <p>2 genetic / genetically determined / inherited ;</p> <p>3 rigid / fixed pattern / inflexible ;</p> <p>4 <u>stereotyped</u> / <u>stereotypical</u> ;</p> <p>5 automatic / does not require thought / does not require learning ;</p>	2 max	<p>2 IGNORE born with it / present from birth</p> <p>3 ACCEPT description. <u>Same</u> in all members of species or performed the <u>same</u> all the time</p>
2	(a)	(ii)	<p>1 (behaviour) <u>changed</u> / <u>altered</u> / <u>learnt</u> , by experience ;</p> <p>2 ref. memory / association / reinforcement / practice ;</p> <p>3 variable ;</p>	2 max	<p>1 ACCEPT taught by parents / learnt by watching others 'due to experience' is not enough. They need to refer to <i>past</i> experience.</p> <p>3 ACCEPT description. Varies or is different in different members of a species or in one animal at different times</p>

Question		Expected Answers	Marks	Additional Guidance
2	(b)	<p><i>general innate behaviour advantages</i></p> <p>A1 rapid / automatic / correct , behaviour / response ; A2 <i>idea that</i> simple nervous system is enough ; A3 suits species with , short lifespan / no parental care / solitary lifestyle ;</p> <p><i>innate behaviour examples with specific advantages</i></p> <p>E1 an escape reflex described in a named animal ; E2 advantage of this escape reflex explained ;</p> <p>E3 a taxis described in a named animal ; E4 advantage of this taxis explained ;</p> <p>E5 a kinesis described in a named animal ; E6 advantage of this kinesis explained ;</p> <p style="text-align: right;"><i>continued</i></p>		<p>Note - The question relates to animal behaviour that is, in broad terms, advantageous for survival.</p> <p>A marks can be awarded in the context of an example</p> <p>E marks the name of the type of behaviour is not needed.</p> <p>Odd E numbers require the animal to be identified and the behaviour described.</p> <p>Even E numbers require an explanation of how the behaviour is advantageous e.g. to keep the animal in a suitable environment / to avoid predation or damage / to find food or a mate. Can be awarded even if corresponding odd E number has not been awarded.</p> <p>E3 ACCEPT motile protocist e.g. <i>Euglena / Paramecium</i></p> <p style="text-align: right;"><i>continued</i></p>

Question		Expected Answers	Marks	Additional Guidance
2	(b)	<p>continued</p> <p><i>general learned behaviour advantages</i></p> <p>A4 flexible / adaptable to , change / environment ;</p> <p><i>learned behaviour examples with specific advantages</i></p> <p>E7 habituation described in a named animal ; E8 advantage of this habituation explained ;</p> <p>E9 imprinting described in a named animal ; E10 advantage of this imprinting explained ;</p> <p>E11 conditioning described in a named animal ; E12 advantage of this conditioning explained ;</p> <p>E13 latent learning described in a named animal ; E14 advantage of this latent learning explained ;</p> <p>E15 insight learning described in a named animal ; E16 advantage of this insight learning explained ;</p> <p>QWC – relating types of behaviour to advantages ;</p>	<p>10 max</p> <p>1</p>	<p>A mark can be awarded in the context of an example</p> <p>E marks the name of the type of behaviour is not needed.</p> <p>Odd E numbers require the animal to be identified and the behaviour described.</p> <p>Even E numbers require an explanation of how the behaviour is advantageous e.g. to conserve energy (habituation) / access care (imprinting) / access food / safety or other reward or survival need</p> <p>E11 ACCEPT description of Pavlov’s dogs for conditioning E12 IGNORE ref. to Pavlov’s dogs</p> <p>QWC = any description mp (odd E) PLUS any advantage mp (even E or A) from both sections</p>
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Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	DNA / gene / genetic , fingerprinting / profiling / analysis ; DNA / protein / gene , sequencing ; electrophoresis ;	1 max	IGNORE gene testing / gene probing / gene mapping / genome sequencing
3	(a)	(ii)	rarely / do not , produce seed / cross-pollinate / interbreed ; <u>only</u> reproduce asexually ;	1 max	
3	(a)	(iii)	<u>vegetative propagation</u> ;	1	IGNORE asexual reproduction (as given in the question)
3	(b)		1 genetically identical / little genetic variation ; 2 all susceptible / none resistant , to <u>this</u> disease ; 3 beetles , move / fly , from tree to tree or beetles are vector ; 4 trees grow , in clonal patch / close together or disease spreads through , suckers / roots or connected by , suckers / roots ; 5 the beetles <u>only</u> , live on / target , elm trees ; 6 attempts at control contributed to spread ; 7 as more trees became diseased then more tree surgery was necessary (contributing to spread of problem) ; 8 as more trees became infected then more , saws / equipment , were contaminated ;	4 max	1 IGNORE clone 2 IGNORE all susceptible to 'disease' in general. Only credit if one particular disease is implied e.g. the / new / fungus / same , disease DO NOT CREDIT immune instead of resistant 3 IGNORE simple repetition of text 'beetles spread disease'

Question			Expected Answers	Marks	Additional Guidance
3	(c)	(i)	<p>1 less / no , movement of water or less / no , water reaches leaves ;</p> <p>2 less / no , minerals / nitrate / phosphate / magnesium / iron ;</p> <p>3 less / no , chlorophyll formation ;</p> <p>4 chlorophyll breakdown / leaf senescence ;</p>	2 max	<p>2 CREDIT correct symbols NO_3^-, PO_4^{2-}, Mg^{2+}, Fe^{2+}, Fe^{3+} IGNORE nutrients IGNORE reference to other substances such as sugars</p>
3	(c)	(ii)	<p>1 less / no , photosynthesis ;</p> <p>2 less / no , sugar(s) / amino acid(s) / assimilates / organic molecules ;</p> <p>3 <u>roots</u> cannot , respire / do active transport / metabolise ;</p> <p>4 the falling leaves carry the fungus ;</p>	2 max	<p>2 CREDIT named sugars, e.g. sucrose , glucose , hexose IGNORE nutrients / food</p>

Question	Expected Answers	Marks	Additional Guidance
3 (d)	<p>1 cut plant material into , explants / small pieces ;</p> <p>2 example of part of plant used e.g. leaf / stem / root / bud / meristem / dividing region at tip of plant ;</p> <p>3 sterilise explant ;</p> <p>4 (with) bleach / sodium hypochlorite / alcohol ;</p> <p>5 place on , agar / growth medium ;</p> <p>6 containing , glucose / amino acids / nitrates / phosphates ;</p> <p>7 callus or mass of , undifferentiated / totipotent , cells ;</p> <p>8 high auxin and cytokinin (for callus formation) ;</p> <p>9 subdivide callus / sub-culturing ;</p> <p>10 treat to induce , roots / shoots ;</p> <p>11 <u>change</u> plant hormone ratio ;</p> <p>12 transfer to , greenhouse / soil / less controlled environment / non-sterile environment ;</p> <p>13 ref. aseptic conditions (anywhere within stages 5-11) ;</p> <p>QWC – described in logical sequence of steps ;</p>	<p>6 max</p> <p>1</p>	<p>1 DO NOT CREDIT a single cutting</p> <p>5 CREDIT place in aerated solution</p> <p>6 IGNORE polymers / carbohydrates</p> <p>7 DO NOT CREDIT description of single cell</p> <p>9 IGNORE ref. single cells</p> <p>11 CREDIT description , e.g. high auxin to give roots or (relatively) high cytokinin to give shoots (auxin : cytokinin ratio = 100 : 1 for roots, 4 : 1 for shoots, or similar figures)</p> <p>13 Do not award for sterilising explant (which is mp3)</p> <p>Award QWC for sequence of marks as follows: either mp 1 or 2 then 1 mark from mps 5 – 8 then 1 mark from mp 9 - 12</p>

Question		Expected Answers	Marks	Additional Guidance
3	(e)	<p><i>advantages</i></p> <p>1 quick ;</p> <p>2 disease-free / virus-free , stock created ;</p> <p>3 plants have same feature / uniform plants created ;</p> <p>4 can reproduce infertile plants ;</p> <p>5 can reproduce plants that are hard to grow from seed ;</p> <p>6 create whole plants from GM cells ;</p> <p>7 production , not determined by seasons / at any time / anywhere in the world ;</p> <p>8 (plantlets small) can be transported easily / grown in small space ;</p> <p>9 can save rare species from extinction ;</p> <p><i>disadvantages</i></p> <p>10 expensive / labour intensive , process ;</p> <p>11 process can fail due to microbial contamination ;</p> <p>12 all offspring susceptible to <i>same</i> , pest / disease / named environmental factor (e.g. drought) ;</p> <p>13 no / low / little , genetic variation ;</p>	4	<p>CREDIT the first answer on each prompt line</p> <p>1 IGNORE ref. large numbers alone</p> <p>3 refers to plant phenotype e.g. plants , grow at same rate / grow to same height</p> <p>12 IGNORE all are susceptible to disease in general (as in 3b)</p> <p>13 IGNORE loss of alleles</p>
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Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	57 / 57.3 ; ;	2	Award 2 marks for a correct answer ACCEPT 57.25 for 2 marks If answer is incorrect then allow 1 working mark for 655 – 280 or for seeing 375 anywhere in the working
4	(a)	(ii)	<p><i>description (D)</i></p> <p>D1 number of , waders / birds , decrease (in area 2) ; D2 (numbers decrease) in , all / four , species ; D3 unlike / different to , area 1 / where hedgehogs absent ; D4 (area 1) two species increase / only two species decrease ; D5 quote any two % change figures ;</p> <p><i>explanation (E)</i></p> <p>E1 hedgehogs are , secondary consumers / ‘predators’ ; E2 hedgehogs , stop birds breeding / reduce offspring (one year) ; E3 <i>idea of fewer</i> , new adults / breeders (next year) ; E4 <i>idea of more deaths</i> than ‘births’ ;</p>	6 max	<p>D1 CREDIT ‘it’ as number ACCEPT ‘amount’ D2 CREDIT the four names if all said to decrease</p> <p>D4 CREDIT lapwing and redshank increase / only dunlin and snipe decrease</p> <p>D5 Percentage change figures: area 1 area 2 lapwing +24 -31 redshank +51 -41 dunlin -31 -56 snipe -10 -57 Look for ecf from 4(a)(i) if snipe in area 2 incorrect</p> <p>E1 IGNORE hedgehogs eat eggs as given in question</p> <p>E3 Look for idea of future / knock-on effect</p>

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(iii)	<p>1 plenty of / enough , food / birds' eggs / space ; 2 breed rapidly / breed successfully / young survive ;</p> <p>3 no / few , predators ; 4 few die (young / before breeding) ;</p> <p>5 <i>idea that</i> hedgehogs are introduced species ; 6 invasive / fill vacant niche / not reached carrying capacity ;</p> <p>7 these hedgehogs restricted to island ; 8 cannot , emigrate / leave island (so numbers build up) ;</p>	4 max	<p>Mark the first suggestion on each numbered line. Award 1 mark for a factor and a further mark for a related explanation</p> <p>1 CREDIT little competition for food</p>
4	(b)		<p><i>idea that the following may be ethically wrong</i></p> <p>1 killing hedgehogs ; 2 letting hedgehogs , kill / decrease number of , waders ; 3 introducing hedgehogs to island (upset the ecosystem) ; 4 catching / moving , hedgehogs might cause suffering ;</p> <p>5 doing nothing ;</p>	3 max	<p>CREDIT ORA <i>idea preventing these is ethically right</i> IGNORE 'right to life' and 'playing God'</p> <p>2 CREDIT ORA need to conserve waders</p> <p>4 '<i>the other methods are cruel</i>' = 1 mark (mp 4) '<i>moving hedgehogs elsewhere causes problem somewhere else</i>' = 1 mark (mp 4)</p> <p>5 CREDIT ORA idea of human responsibility</p>
				15	

Question		Expected Answers	Marks	Additional Guidance
5	(a)	1 methionine 2 arginine 4 threonine 5 tryptophan ; ;	2	AWARD 2 marks if all four correct AWARD 1 mark if two or three correct AWARD 0 marks if only one correct IGNORE incorrect spelling if meaning is clear
5	(b)	<u>translation</u> ; <u>ribosome</u> / <u>rough</u> ER / <u>RER</u> ;	2	IGNORE ER alone DO NOT CREDIT smooth ER
5	(c)	messenger / m ; RNA / ribonucleic acid ;	2	<i>mRNA</i> ' = 2 marks IGNORE incorrect 'r' or 't' prefix for 2 nd mark
5	(d)	UAA and UAG and UGA ; do not code for an amino acid / no matching tRNA ;	2	NEED all 3 for one mark ACCEPT do not code for anything ACCEPT no , matching / complementary , anticodon
5	(e)	neutral / silent / substitution / point ;	1	
			9	

Question		Expected Answers	Marks	Additional Guidance
6	(a)	<p><i>somatic</i> changes / uses , body cells ; change cannot be passed to offspring ; cures / alleviates , genetic disease in one individual ; short-lived / repeat treatments needed ;</p> <p><i>germ line</i> changes / uses , gametes / zygote / embryo / reproductive tissue ; banned ;</p>	2 max	<p>ORA germ line changes could be passed to offspring</p> <p>ACCEPT sperm / eggs</p>
6	(b)	<p><i>central</i> C1 brain and spinal cord ; C2 intermediate neurones ; C3 has , coordinating role / many synapses ;</p> <p><i>peripheral</i> max 3 P1 <u>nerves</u> , from sense organs / to muscles / to glands ; P2 sensory and motor , neurones / nerve cells ;</p> <p>P3 role in , sensing stimuli / controlling effectors or conducting impulses, to / from , CNS / brain / spinal cord ; P4 includes , somatic / autonomic / sympathetic / parasympathetic ;</p>	4 max	<p>For full marks needs at least 1 C mark</p> <p>C2 CREDIT relay / internuncial / bipolar C3 IGNORE processing</p> <p>P1 IGNORE effectors P2 DO NOT CREDIT if intermediate included DO NOT CREDIT nerves</p> <p>P3 IGNORE messages / signals / information</p>
6	(c)	<p><i>prophase 1</i> <u>homologous chromosomes</u> pair up / <u>bivalents</u> form ; <u>chiasmata</u> / crossing-over / recombination ;</p>	2	<p>CREDIT reverse arguments for prophase 2</p> <p>ACCEPT description e.g. <u>non-sister chromatids</u> exchange , (matching sections of) DNA / alleles / genetic material</p>
			8	

Question			Expected Answers	Marks	Additional Guidance
7	(a)	(i)	<p>1 sweep netting / sweep vegetation with a net ;</p> <p>2 beating / beat trees and bushes ;</p> <p>3 pooter / pooting / described ;</p>	1 max	<p>2 ACCEPT fogging</p> <p>3 ACCEPT pitfall traps / described</p>
7	(a)	(ii)	<p><i>idea of ladybirds not evenly distributed /</i></p> <p>some parts of hill different /</p> <p>more representative ;</p> <p>lets <u>reliability</u> be assessed / anomalies identified ;</p>	1 max	<p>ACCEPT description</p> <p>e.g. could be more ladybirds one side than another</p> <p>ACCEPT increases reliability</p> <p>IGNORE accuracy / precision / removes anomalies</p>
7	(b)	(i)	<p>M1 (calculate) % / proportion / ratio ;</p> <p>E1 as different total numbers at each site ;</p> <p>or</p> <p>M2 (draw) bar chart / kite diagram ;</p> <p>E2 pictorial data easier to understand ;</p>	2 max	<p>M1 IGNORE χ^2</p> <p>M2 IGNORE histogram / line graph</p>

Question			Expected Answers	Marks	Additional Guidance
7	(b)	(ii)	<p><i>yes (for first statement)</i></p> <p>1 first statement true / correlation exists ;</p> <p>2 number of black ladybirds increase , from 100m to 300m / until 300m ;</p> <p>3 400m number decrease but % black increases ;</p> <p><i>no (for second statement)</i></p> <p>4 correlation not proof of causation / no proof of causal link / second statement not (necessarily) true ;</p> <p>5 another (named) factor could be involved ;</p>	3 max	<p>If candidates argues 'yes' exclusively, can only be awarded mps 1-3</p> <p>If candidate answers 'no' exclusively, can only be awarded mps 4 & 5</p> <p><i>Note percentage of black ladybirds increases as you go up the hill = 2 marks (mps 2 & 3)</i></p> <p>5 CREDIT could be due to distance from town / more or less predation high up / camouflage / warning colours</p>
7	(c)	(i)	<p>only expressed , when homozygous / in absence of dominant (allele) ;</p> <p>not expressed when heterozygous / expression masked by dominant (allele) ;</p>	1 max	<p>DO NOT CREDIT gene</p> <p>IGNORE letters / genotypes</p> <p>ACCEPT only seen in phenotype when it is present in 'double dose'</p>

Question			Expected Answers	Marks	Additional Guidance
7	(c)	(ii)	<p>1 $q^2 = 296 / 346$ or $0.85 / 0.855 / 0.86$;</p> <p>2 $q = \sqrt{\text{previous answer}}$ or $0.92 / 0.93$;</p> <p>3 $p = 1 - \text{previous answer}$ or $0.08 / 0.07$;</p>		<p>1 DO NOT CREDIT calculation or figure unless it has been indicated as q^2</p> <p>2 ACCEPT ecf</p> <p>3 ACCEPT ecf</p> <p>Note If both p and q are correct = 3 marks <i>If p and q not given to 2 decimal places then penalise 1 mark and then apply ecf</i></p> <ul style="list-style-type: none"> • If the 2 final answers add up to 1 give mp 3, then look for evidence of mps 1 or 2 in the working • If the 2 final answers do not add up to 1, look for evidence of mps 1, 2 & 3 in the working • Award the working mark(s) if method correct, even if subsequent calculation incorrect (e.g. $1 - 0.54 = 0.56$ could get mp 3 for '1 – previous answer' even though 0.56 is the incorrect answer for the calculation) <p><i>e.g. if black allele wrongly assumed to be recessive</i> $q = 0.38$ or $q = \sqrt{0.1445}$ give mp 2 as ecf $p = 0.62$ or $p = 1 - 0.38$ give mp 3 as ecf</p> <p><i>e.g. if answer given as</i> $q = 0.85$ and $p = 0.15$ give mp 3 They will not get mp 1 as they think that $296/346 = q$ (rather than q^2) and so will not square root it so they won't get mp 2</p> <p>3</p>
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