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**Artificial intelligence (AI): years 9 and 10**

The following table identifies how the key aspects of understanding how AI works, types of AI, and responsible use and application of AI are evident in content descriptions from across the Australian Curriculum Version 9.0. From this information, teachers can develop a sequential program for learning about AI by connecting the key aspects of learning with learning area and subject-specific content descriptions.

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| Years 9 and 10 | | | |
| Key aspect 1: Understanding how AI works | | | |
| Learning area/subject | Strand/sub-strand | Content descriptions | Content elaborations |
| **Digital Technologies** | **Knowledge and understanding**  Digital Systems | investigate how hardware and software manage, control and secure access to data in networked digital systems  AC9TDI10K01 | * explaining how the operating system hides the complexity of different hardware from applications, for example applications can treat input from a mouse and touch screen in the same way * exploring how public key cryptography, for example TLS, and hashing, such as SHA-1, secure the storage and transmission of data * configuring a simple network using real or simulated hardware and observing packets moving around the network, for example monitoring packets on simulated switches and networked devices * explaining how domain names and IP addresses allow data to be transmitted to specific networked devices, for example DNS and routing tables * describing elements of access control and explaining why they are necessary, for example authentication and permissions for restricting access to install software to administrators |
| **Knowledge and understanding**  Data representation | investigate simple data compression techniques  AC9TDI10K03 | * using an algorithm to identify patterns in data and represent them in a compressed way, for example repeated pixels in an image with run-length encoding * exploring the difference between lossy and lossless compression and the consequences of each, for example exploring codecs for audiovisual compression such as MP3, MP4 and WAV formats, considering energy requirements of file sizes * examining an image and discussing whether the image quality would be compromised if all the blue pixels of the sky in one row were to be replaced by one token and the number of pixels it represents |
| **Processes and production skills**  Acquiring, managing and analysing data | develop techniques to acquire, store and validate data from a range of sources using software, including spreadsheets and databases  AC9TDI10P01 | * developing systems that store structured data, for example a movie or travel review website that collects Likert scale ratings and written reviews * developing systems that check data is correct and meaningful using automated techniques and manual analysis, for example, validating movie review data using rules and user interface elements, and detecting bias and fake reviews through simple statistical analysis * developing systems that acquire, use and protect data according to the Australian Privacy Principles, for example ensuring personally identifiable information is not publicly shared without consent and is protected from unauthorised access * accessing and storing data from the Australian Bureau of Statistics in a format that is useful for analysis, for example acquiring data on the population growth across age groups in Australia * identifying strengths and weaknesses of collecting data using different methods, for example online surveys, face-to-face interviews, phone interviews, observation, comments in response to a social media posting, phone logs, browser history and online webcam systems * considering how training data issues such as the zero problem dictate the output from predictive models; for example, a model with many examples of horses and no zebras in its training data is likely to classify all zebras as horses |
| analyse and visualise data interactively using a range of software, including spreadsheets and databases, to draw conclusions and make predictions by identifying trends and outliers  AC9TDI10P02 | * summarising data, its attributes and the relationships between data sets, identifying trends and outliers to draw conclusions and make predictions, for example summarising data about electorates and their demographics, historical swings and exceptions to predict an election outcome * developing interactive visualisations for exploring complex data, for example population, life expectancy and fertility rate in motion charts * using software to visualise and compare data to identify patterns, relationships and trends, for example investigating emerging trends in Australia's industries * exploring machine learning, a form of artificial intelligence where an algorithm is trained using a data set, for example to classify images into categories * adjusting parameters of an AI model to observe the impact of different factors on predicted outcomes; for example, changing the weighting of different input variables to see how much it changes the model's outputs |
| model and query entities and their relationships using structured data  AC9TDI10P03 | * modelling entities and processes, their attributes and the relationships between them, for example creating database tables for a movie, a user and their movie review, where a movie has a title, genre and release date, and a review has a movie, a user and their rating and comments * using structured data to help in decision-making, for example creating a data schema for a relational database and building the database, incorporating query and reporting functionality to solve a problem of student choice * interpreting and querying multi-table databases using SQL queries with SELECT, WHERE and simple JOIN/GROUP BY clauses and counting, for example checking that each user has only reviewed each movie once |
| **Processes and production skills**  Generating and designing | design algorithms  involving logical operators and represent them as flowcharts and pseudocode  AC9TDI10P05 | * designing an algorithm or modifying an existing algorithm to fix, extend or improve it, for example fixing a bug in an algorithm to detect if 2 shapes intersect when the shapes just touch or extending the algorithm to support a new shape * describing algorithms using flowcharts or other appropriate diagram types, for example a decision tree for classifying an animal based on physical characteristics * describing algorithms precisely and succinctly using pseudocode, for example short, unambiguous statements such as IF length of word is greater than 4 AND first letter is a vowel * using Boolean operations (that is, AND, OR and NOT) to express complex conditions in control structures, for example IF [the temperature is above 30 degrees AND people are inside the building] THEN open the windows |
| validate algorithms and programs by comparing their output against a range of test cases  AC9TDI10P06 | * tracing and debugging an algorithm by identifying when its state is unexpected, why this has occurred, and the changes needed to correct it, for example identifying that a loop has finished one iteration too early * determining boundary test cases and testing that they are handled correctly by a program, for example checking that an intersection is detected when 2 shapes are perfectly aligned * generating invalid input and user errors and testing that they are handled appropriately by a program, for example checking that a program does not crash when text is entered instead of a number |
| **Processes and production skills**  Producing and implementing | implement, modify and debug modular programs, applying selected algorithms and data structures, including in an object-oriented programming language  AC9TDI10P09 | * writing and editing programs to solve problems using algorithms and data structures in general-purpose and object-oriented programming languages, such as Python, JavaScript or C# * debugging a program by locating an error, modifying the program, and verifying that the changes made are correct, for example identifying the line in the code where an error occurs by reading an error message, printing out the variables to deduce what is causing the problem, and testing any fixes by entering data that could create similar errors * reading and interpreting programs split across files, functions or classes, and modifying them to add functionality, for example using the codebase of an existing adventure game and building new characters, levels or abilities * writing programs that receive structured data from the user that determines the program's behaviour, for example processing a file that contains timestamped data captured by an altitude sensor from a plastic bottle rocket to graph its flight path * applying simple data structures and algorithms appropriately in their programs, for example using an array to store temperature data for a month, a dictionary to store character information in a role-playing game (RPG), and the binary search function from a library to find a value in a sorted array * defining their own classes to model and define the actions that can be performed on data in their programs, for example defining a class for a book that stores information such as the author, title and publisher, and methods that are used to track the book's status in a library management system or store inventory * selecting different types of data structures such as array, record and object to model structured data |
| **Processes and production skills**  Privacy and security | develop cyber security threat models, and explore a software, user or software supply chain vulnerability  AC9TDI10P13 | * using a data flow diagram to understand how private information moves through a system and when it would be the most likely target of a cyber attack, for example mapping how data moves between the user and server when using a web application, and identifying that sending the data in plaintext would make it susceptible to a man-in-the-middle attack * exploring the impact of a cyber security threat by systematically following the steps involved in bypassing a known vulnerability in their own software, for example manually changing the value stored in a login cookie to that of another user to observe the impact of unauthorised access on the system * explaining how techniques like prompt injection can change the intended behaviour of generative AI models; for example, carefully chosen inputs can circumvent any protections or limitations that may have been included in the design of the model |
| apply the Australian Privacy Principles to critique and manage the digital footprint that existing systems and student solutions collect  AC9TDI10P14 | * critiquing the extent to which online services allow them to control access to their data in line with the Australian Privacy Principles, for example assessing whether their social media accounts allow them to update their contact information if these details change, and who else can see that information on the platform * using the Australian Privacy Principles as a reference to evaluate the steps they are taking to protect user information in their application, for example explaining how they are storing passwords using cryptographic hashing algorithms so that a data breach does not expose their users to security vulnerabilities due to password re-use |
| **Mathematics – Year 9** | **Algebra** | find the gradient of a line segment, the midpoint of the line interval and the distance between 2 distinct points on the Cartesian plane  AC9M9A03 | * investigating how coordinate geometry and aspects of linear algebra play a fundamental role in machine learning and predictive algorithms; for example, object detection and navigation by autonomous vehicles |
| experiment with the effects of the variation of parameters on graphs of related functions, using digital tools, making connections between graphical and algebraic representations, and generalising emerging patterns  AC9M9A06 | * investigating how experimenting with the effects of the variation of parameters of related functions can provide artificial intelligence researchers insights into the predictive behaviour of artificial intelligence models |
| **Measurement** | solve spatial problems, applying angle properties, scale, similarity, Pythagoras’ theorem and trigonometry in right-angled triangles  AC9M9M03 | * investigating how autonomous vehicles solve spatial problems using algorithms based on geometric properties relating to angles, distances and scale |
| calculate and interpret absolute, relative and percentage errors in measurements, recognising that all measurements are estimates  AC9M9M04 | * investigating how calculating and interpreting absolute, relative and percentage errors in measurements relates to artificial intelligence systems such as regression models, estimating uncertainty and recommendation systems |
| **Space** | design, test and refine algorithms involving a sequence of steps and decisions based on geometric constructions and theorems; discuss and evaluate refinements  AC9M9SP03 | * creating an algorithm using pseudocode or flow charts to apply the triangle inequality, or an algorithm to generate Pythagorean triples * creating and testing algorithms designed to construct or bisect angles, using pseudocode or flow charts * developing an algorithm for an animation of a geometric construction, or a visual proof, evaluating the algorithm using test cases |
| **Statistics** | analyse reports of surveys in digital media and elsewhere for information on how data was obtained to estimate population means and medians  AC9M9ST01 | * exploring how natural language processing (NLP) tools can be used to help analyse large volumes of survey reports in digital media, expediting various processes, and discussing the benefits or limitations of using these tools |
| analyse how different sampling methods can affect the results of surveys and how choice of representation can be used to support a particular point of view  AC9M9ST02 | * exploring potential cultural bias relating to First Nations Australians by critically analysing sampling techniques in statistical reports |
| represent the distribution of multiple data sets for numerical variables using comparative representations; compare data distributions with consideration of centre, spread and shape, and the effect of outliers on these measures  AC9M9ST03 | * using digital tools, including generative artificial intelligence, to generate different data displays and visualisations using existing data sets, and discussing which form is more appropriate for the given context |
| **Probability** | calculate relative frequencies from given or collected data to estimate probabilities of events involving “and”, inclusive “or” and exclusive “or”  AC9M9P02 | * designing, testing and refining an algorithm used to determine relative frequencies from a generated data set, to estimate different probabilities |
| design and conduct repeated chance experiments and simulations, using digital tools to compare probabilities of simple events to related compound events, and describe results  AC9M9P03 | * using digital tools to conduct probability simulations that demonstrate the relationship between the probability of compound events and the individual probabilities * comparing experiments which differ only by being undertaken with replacement or without replacement * conducting two-step chance experiments using systematic methods to list outcomes of experiments and to list outcomes favourable to an event * using repeated trials of First Nations Australian children’s instructive games; for example, Gorri from all parts of Australia, to calculate the probabilities of winning and not winning |
| **Mathematics – Year 10** | **Algebra** | experiment with functions and relations using digital tools, making and testing conjectures and generalising emerging patterns  AC9M10A05 | * investigating how functions and relations serve as the mathematical underpinnings of machine learning, allowing data to be transformed, models to be defined and optimisation to occur |

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|  | **Measurement** | interpret and use logarithmic scales in applied contexts involving small and large quantities and change  AC9M10M02 | * investigating how logarithmic scaling can be used in machine learning algorithms to compress large values while preserving small ones, allowing the algorithms to efficiently work on problems with a wide range of values |
| solve practical problems applying Pythagoras’ theorem and trigonometry of right-angled triangles, including problems involving direction and angles of elevation and depression  AC9M10M03 | * investigating how autonomous vehicles use algorithms that use Pythagoras' theorem and trigonometry to calculate distance and navigate spaces; for example, if an autonomous vehicle knows its current position (x, y) and the coordinates of a target location (x', y'), it can determine the straight-line distance between them using the theorem distance = |
| identify the impact of measurement errors on the accuracy of results in practical contexts  AC9M10M04 | * investigating the impact of measurement errors in the perception and control systems of autonomous vehicles, such as measurement errors due to sensor limitations |
| use mathematical modelling to solve practical problems involving proportion and scaling of objects; formulate problems and interpret solutions in terms of the situation; evaluate and modify models as necessary, and report assumptions, methods and findings  AC9M10M05 | * investigating how artificial intelligence image generators use proportion and scaling techniques, such as aspect ratio preservation, to ensure that the generated content adheres to realistic visual principles and maintains appropriate relationships between objects and elements within the scene |
| **Space** | apply deductive reasoning to proofs involving shapes in the plane and use theorems to solve spatial problems  AC9M10SP01 | * investigating how automated theorem provers (ATP) and interactive proof assistants (IPA) allow mathematicians and artificial intelligence systems to work collaboratively to construct or test formal proofs |
| interpret networks and network diagrams used to represent relationships in practical situations and describe connectedness  AC9M10SP02 |  |
| design, test and refine solutions to spatial problems using algorithms and digital tools; communicate and justify solutions  AC9M10SP03 | * designing and making scale models of three-dimensional objects using digital tools; for example, making components of a puzzle using a three-dimensional printer, planning and designing the puzzle using principles of tessellations * applying a computational thinking approach to solving problems involving networks; for example, connectedness, coverage and weighted measures; taking different routes and choosing the most efficient route to take when travelling by car using virtual map software * defining and decomposing spatial problems, creating and applying algorithms to generate solutions, evaluating and communicating solutions in terms of the problem; for example, designing a floor plan for a department store that limits congestion at key areas such as checkouts, changing rooms and popular sale items * designing, creating and testing algorithms using pseudocode or flow charts for producing self-similar patterns; validating algorithms using a range of test cases to compare their output |

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|  | **Statistics** | analyse claims, inferences and conclusions of statistical reports in the media, including ethical considerations and identification of potential sources of bias  AC9M10ST01 | * recognising how the identification of bias is a critical aspect of machine learning and deep learning because biases can significantly impact the fairness, accuracy and ethical implications of artificial intelligence systems |
| compare data distributions for continuous numerical variables using appropriate data displays including boxplots; discuss the shapes of these distributions in terms of centre, spread, shape and outliers in the context of the data  AC9M10ST02 | * exploring how the identification and appropriate handling of outliers is an important step in machine learning to ensure that they don't unduly influence the model |
| construct scatterplots and comment on the association between the 2 numerical variables in terms of strength, direction and linearity  AC9M10ST03 | * exploring how scatterplots and association help data scientists gain insights into the data, identify relationships, and can be applied to machine learning to make informed decisions about feature engineering and assess model performance * investigating artificial intelligence systems that analyse bivariate data to forecast or make predictions based on association using correlation analysis and discussing limitations; for example, the artificial intelligence may not capture the causality between variables or account for the contextual or ethical implications |

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|  | **Probability** | use the language of “if .... then”, “given”, “of”, “knowing that” to describe and interpret situations involving conditional probability  AC9M10P01 | * investigating how conditional probability is used in natural language processing tasks like text generation or language translation and recommendation systems |
| design and conduct repeated chance experiments and simulations using digital tools to model conditional probability and interpret results  AC9M10P02 | * using samples of different sizes with and without replacement from a population to identify when the difference in methods becomes negligible * recognising that an event can be dependent on another event and that this will affect the way its probability is calculated * using simulations to gather data on frequencies for situations involving chance that appear to be counter-intuitive, such as the three-door problem or the birthday problem |

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| Years 9 and 10 | | | |
| Key aspect 2: Types of AI | | | |
| Learning area/subject | Strand/sub-strand | Content descriptions | Content elaborations |
| **Digital Technologies** | **Knowledge and understanding**  Digital systems | investigate how hardware and software manage, control and secure access to data in networked digital systems  AC9TDI10K01 | * explaining how the operating system hides the complexity of different hardware from applications, for example applications can treat input from a mouse and touch screen in the same way * exploring how public key cryptography, for example TLS, and hashing, such as SHA-1, secure the storage and transmission of data * configuring a simple network using real or simulated hardware and observing packets moving around the network, for example monitoring packets on simulated switches and networked devices * explaining how domain names and IP addresses allow data to be transmitted to specific networked devices, for example DNS and routing tables * describing elements of access control and explaining why they are necessary, for example authentication and permissions for restricting access to install software to administrators |
| **Processes and production skills**  Acquiring, managing and analysing data | analyse and visualise data interactively using a range of software, including spreadsheets and databases, to draw conclusions and make predictions by identifying trends and outliers  AC9TDI10P02 | * summarising data, its attributes and the relationships between data sets, identifying trends and outliers to draw conclusions and make predictions, for example summarising data about electorates and their demographics, historical swings and exceptions to predict an election outcome * developing interactive visualisations for exploring complex data, for example population, life expectancy and fertility rate in motion charts * using software to visualise and compare data to identify patterns, relationships and trends, for example investigating emerging trends in Australia's industries * exploring machine learning, a form of artificial intelligence where an algorithm is trained using a data set, for example to classify images into categories * adjusting parameters of an AI model to observe the impact of different factors on predicted outcomes; for example, changing the weighting of different input variables to see how much it changes the model's outputs |
| model and query entities and their relationships using  structured data  AC9TDI10P03 | * modelling entities and processes, their attributes and the relationships between them, for example creating database tables for a movie, a user and their movie review, where a movie has a title, genre and release date, and a review has a movie, a user and their rating and comments * using structured data to help in decision-making, for example creating a data schema for a relational database and building the database, incorporating query and reporting functionality to solve a problem of student choice * interpreting and querying multi-table databases using SQL queries with SELECT, WHERE and simple JOIN/GROUP BY clauses and counting, for example checking that each user has only reviewed each movie once |
| **Processes and production skills**  Evaluating | evaluate existing and student solutions against the design criteria, user stories, possible future impact and opportunities for enterprise  AC9TDI10P10 | * evaluating how an existing solution detects violations of site rules and imposes sanctions as described in the Safety by Design Vision for Young People, for example enforcing rules using artificial intelligence and human moderators to detect inappropriate behaviour, and consistently imposing consequences * judging the quality of the output of their solution against the design criteria, for example confirming that the stock levels recorded by their inventory management application are accurate within allowed parameters * evaluating how existing products have pivoted to meet the needs of a different set of users, for example how new social media applications continue to expand the types of media people share and the interactions they have online * examining the unintended consequences of an image generation solution implemented using AI; for example, using a model trained on a homogenous population to generate graphics that do not represent the diversity of customers in a website’s target audience * considering the complexities associated with training predictive models to capture events that occur with low probability; for example, in training data for an autonomous vehicle, including a person lying on the road and the correct behaviour for that situation |
| **Digital Technologies** | **Processes and production skills**  Collaborating and managing | select and use emerging digital tools and advanced features to create and communicate interactive content for a diverse audience  AC9TDI10P11 | * combining the output from multiple generative AI sources to communicate a complex idea or narrative; for example, using images, sounds and text from a variety of tools to produce an interactive animation |
| **Design and Technologies** | **Knowledge and understanding**  Technologies and society | analyse how people in design and technologies occupations consider ethical, security and sustainability factors to innovate and improve products, services and environments  AC9TDE10K01 | * analysing design and technologies professions and their contributions to society, for example engineers working in disaster recovery or empowering communities to improve access to clean, safe energy * recognising the impact of past designed solutions when creating solutions for preferred futures, for example the design of public transport systems that use renewable energy and are accessible, and the design of rural community environments to reduce fire risk * considering the factors that influence design and manufacture, and the work of professional designers, engineers and technologists, including time, access to skills, knowledge, finance, expertise in global engineering and manufacturing, for example Australian designers and engineers working with rapid prototyping manufacturers in a country in Asia or the significance of the collaboration between Australia and Vietnam on the development of the Cao Lanh Bridge * examining mass production systems taking into account ethics and sustainability considerations, for example the mass production of food, clothing and shoes and why manufacturers produce different versions of the same product and support complete product life cycle strategies * explaining the consequences of ethical and sustainability decisions for products, services and environments, for example the accessibility of a managed public environment, the design of roads to include aerial bridges for wildlife and signage powered with solar technologies |
| analyse the impact of innovation, enterprise and emerging technologies on designed solutions for global preferred futures  AC9TDE10K02 | * exploring the ways commercial enterprises respond to the challenges and opportunities of technological change, for example e-commerce, and considering their carbon footprint * investigating scenarios of how the future may unfold and what opportunities and impacts there may be for society and particular groups in a preferred future, for example by using forecasting and backcasting techniques * examining real-world problems and understanding basic needs when considering designed solutions, for example students collaborating to design solutions to challenges in the Asia region; or artists from a country in South-East Asia creating posters for the world to take action in a pandemic |
| **Knowledge and understanding**  Technologies context: Food and fibre production | analyse and make judgements on the ethical, secure and sustainable production and marketing of food and fibre enterprises  AC9TDE10K04 | * examining emerging production technologies and methods in terms of productivity, profitability and sustainability, for example taking account of animal welfare considerations in food and fibre production enterprises, protected cropping, hydroponics or aquaculture * investigating how digital tools could be used to enhance food production systems, for example global positioning systems (GPS) for managing animals, crop sensors, automated animal-feeding or milking systems, or drones for locating and managing weeds |
| **Knowledge and understanding**  Technologies context: Food Specialisations | analyse and make judgements on how the sensory and functional properties of food influence the design and preparation of sustainable food solutions for healthy eating  AC9TDE10K05 | * investigating ways innovations may influence human health and sustainability, for example 3D printing of foods, Internet of Things (IoT) network in the food supply chain or use of augmented reality (AR) in food labelling |
| **Mathematics – Year 9** | **Algebra** | find the gradient of a line segment, the midpoint of the line interval and the distance between 2 distinct points on the Cartesian plane  AC9M9A03 | * investigating how coordinate geometry and aspects of linear algebra play a fundamental role in machine learning and predictive algorithms; for example, object detection and navigation by autonomous vehicles |
| **Space** | apply the enlargement transformation to shapes and objects using dynamic geometry software as appropriate; identify and explain aspects that remain the same and those that change  AC9M9SP02 | * investigating how AI computer vision uses generative adversarial networks (GANs) to generate images or data that resemble real-world objects, scenes or artistic creations, applying concepts relating to enlargement transformations, ratios and proportions |
| **Mathematics – Year 10** | **Space** | design, test and refine solutions to spatial problems using algorithms and digital tools; communicate and justify solutions  AC9M10SP03 | * applying a computational thinking approach to solving problems involving networks; for example, connectedness, coverage and weighted measures; taking different routes and choosing the most efficient route to take when travelling by car using virtual map software * defining and decomposing spatial problems, creating and applying algorithms to generate solutions, evaluating and communicating solutions in terms of the problem; for example, designing a floor plan for a department store that limits congestion at key areas such as checkouts, changing rooms and popular sale items |
| **Statistics** | construct scatterplots and comment on the association between the 2 numerical variables in terms of strength, direction and linearity  AC9M10ST03 | * investigating artificial intelligence systems that analyse bivariate data to forecast or make predictions based on association using correlation analysis and discussing limitations; for example, the artificial intelligence may not capture the causality between variables or account for the contextual or ethical implications |
| **Probability** | design and conduct repeated chance experiments and simulations using digital tools to model conditional probability and interpret results  AC9M10P02 | * identifying situations in real-life where probability simulations are used for decision-making, such as supply and demand of product, insurance risk and queueing * using simulation to predict the number of people likely to be infected with a strain of flu or virus |
| **Science – Year 9** | **Science inquiry**  Planning and conducting | select and use equipment to generate and record data with precision to obtain useful sample sizes and replicable data, using digital tools as appropriate  AC9S9I03 | * considering the replicability of data collected using different instruments, including the inaccuracies that may be introduced when taking measurements * discussing the amount of data needed to produce a useful sample size and why sample size is important * considering an appropriate sample size for the investigation, and how the use of digital tools might enable more-efficient data collection for larger sample sizes |
| **Science inquiry**  Processing, modelling and analysing | select and construct appropriate representations, including tables, graphs, descriptive statistics, models and mathematical relationships, to organise and process data and information  AC9S9I04 | * applying algorithms to measure carbon storage of different vegetation types |
| **Science as a human endeavour**  Use and influence of science | examine how the values and needs of society influence the focus of scientific research  AC9S9H04 | * exploring how Australia has developed an artificial intelligence system which is used to predict the likelihood of a viable pregnancy from transfer of a single embryo to a woman undergoing in-vitro fertilisation |
| **Science – Year 10** | **Science inquiry**  Planning and conducting | select and use equipment to generate and record data with precision to obtain useful sample sizes and replicable data, using digital tools as appropriate  AC9S10I03 | * explaining how estimation affects precision and examining the inaccuracy introduced when reading between scale markings * identifying how human error can affect replicability and reproducibility * deciding how much data is needed to produce valid conclusions |
| **Science as a human endeavour**  Use and influence of science | examine how the values and needs of society influence the focus of scientific research  AC9S10H04 | * considering the use of genetic testing for decisions such as genetic counselling, embryo selection, identification of carriers of genetic mutations and the use of this information for personal use or by organisations such as insurance companies or medical facilities * examining the link between scientific research and real-world applications such as space research and new material development |

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| Years 9 and 10 | | | |
| Key aspect 3: Responsible use and application of AI | | | |
| Learning area/subject | Strand/sub-strand | Content descriptions | Content elaborations |
| **Digital Technologies** | **Processes and production skills**  Investigating and defining | define and decompose real-world problems with design criteria and by interviewing stakeholders to create user stories  AC9TDI10P04 | * creating user stories by interviewing a stakeholder to complete a template such as "As a <type of user>, I want <some goal> so that <some reason>", for example interviewing an amateur athlete to complete the template, such as "As an athlete, I want to ensure my energy intake is high enough to complete a half marathon." * defining the problem with precision and some awareness of scope, for example "How do we encourage people to balance their energy intake and expenditure?" and "Can this be solved in a specified timeframe?" * asking questions that help them define the problem more precisely, for example "How do we measure energy intake?" or "How much energy does each exercise expend?" * recognising the importance of diverse perspectives when defining the problem and devising survey or interview questions to elicit stakeholder needs, for example “What types of exercise count?” and allowing open-ended responses to the exercise they do * exploring how First Nations Australian cultural stories and languages are being preserved with digital systems, for example how communities could record, animate and maintain their connections with culture and language in a contemporary format that resonates with young people to help ensure that vital practices continue |
| **Processes and production skills**  Generating and designing | design and prototype the user experience of a digital system  AC9TDI10P07 | * designing engaging user experiences, considering aesthetics, functionality and the feeling of enjoyment and satisfaction of the user * prototyping a user experience, using simple graphical tools that support clicking on an image to change slides or views, for example using a presentation tool or a no-code user interface prototyping tool to design a simple mobile app * considering all aspects of a product as perceived by the users, for example evaluating users’ initial experience of setting up and using a system, or users’ emotional or cultural response to using a digital system * designing documentation, branding and marketing for a digital solution, for example a product demonstration screencast or ‘getting started’ user guide |
| generate, modify, communicate and critically evaluate alternative designs  AC9TDI10P08 | * eliminating design ideas by evaluating them against the design criteria and user stories, for example in consultation with stakeholders, reviewing the design ideas, making modifications if necessary, and further developing the design of the preferred solution * using a range of ideation techniques to create multiple design ideas for a solution, for example using graphic organisers, role-play and mind mapping to develop and then record a range of ideas without evaluating them first * combining the output from generative AI models and human capital from recognised experts to meet a specific need; for example, using a range of outputs from an image generator as inspiration for modelling a 3D character in a game |
| **Processes and production skills**  Producing and implementing | implement, modify and debug modular programs, applying selected algorithms and data structures, including in an object-oriented programming language  AC9TDI10P09 | * writing and editing programs to solve problems using algorithms and data structures in general-purpose and object-oriented programming languages, such as Python, JavaScript or C# * debugging a program by locating an error, modifying the program, and verifying that the changes made are correct, for example identifying the line in the code where an error occurs by reading an error message, printing out the variables to deduce what is causing the problem, and testing any fixes by entering data that could create similar errors * reading and interpreting programs split across files, functions or classes, and modifying them to add functionality, for example using the codebase of an existing adventure game and building new characters, levels or abilities * writing programs that receive structured data from the user that determines the program's behaviour, for example processing a file that contains timestamped data captured by an altitude sensor from a plastic bottle rocket to graph its flight path * applying simple data structures and algorithms appropriately in their programs, for example using an array to store temperature data for a month, a dictionary to store character information in a role-playing game (RPG), and the binary search function from a library to find a value in a sorted array * defining their own classes to model and define the actions that can be performed on data in their programs, for example defining a class for a book that stores information such as the author, title and publisher, and methods that are used to track the book's status in a library management system or store inventory * selecting different types of data structures such as array, record and object to model structured data |
| **Processes and production skills**  Evaluating | evaluate existing and student solutions against the design criteria, user stories, possible future impact and opportunities for enterprise  AC9TDI10P10 | * evaluating how an existing solution detects violations of site rules and imposes sanctions as described in the Safety by Design Vision for Young People, for example enforcing rules using artificial intelligence and human moderators to detect inappropriate behaviour, and consistently imposing consequences * judging the quality of the output of their solution against the design criteria, for example confirming that the stock levels recorded by their inventory management application are accurate within allowed parameters * evaluating how existing products have pivoted to meet the needs of a different set of users, for example how new social media applications continue to expand the types of media people share and the interactions they have online * examining the unintended consequences of an image generation solution implemented using AI; for example, using a model trained on a homogenous population to generate graphics that do not represent the diversity of customers in a website’s target audience * considering the complexities associated with training predictive models to capture events that occur with low probability; for example, in training data for an autonomous vehicle, including a person lying on the road and the correct behaviour for that situation |

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|  | **Processes and production skills**  Collaborating and managing | select and use emerging digital tools and advanced features to create and communicate interactive content for a diverse audience  AC9TDI10P11 | * locating relevant content by using Boolean operators or artificial intelligence search features of search engines and desktop search, for example queries with 'and' and 'not' or advanced image similarity search * using emerging technologies to add dynamic features to content, for example using a QR code to trigger an augmented reality (AR) overlay of how to use a tool safely in the workshop * incorporating interactive elements into content to assist with analysis, for example adding sliders to visualisations to allow the user to control and view time series data * ensuring content is accessible by using built-in accessibility features, for example using ALT tags in images inside HTML to ensure screen readers can communicate content for people who are visually impaired * combining the output from multiple generative AI sources to communicate a complex idea or narrative; for example, using images, sounds and text from a variety of tools to produce an interactive animation |
| use simple project management tools to plan and manage individual and collaborative agile projects, accounting for risks and responsibilities  AC9TDI10P12 | * managing collaborative projects using appropriate platforms, for example sharing code development using a collaborative version control tool such as GitHub to plan, decompose and manage a project with their peers * establishing clear lines of responsibility and tasks for all members of a project team, for example assigning roles to all team members and using a spreadsheet to sequence tasks and track progress to ensure all work is completed by a specified deadline * using relevant legislation or guidelines to inform their solutions, for example correctly controlling and treating data collected from users by applying techniques that ensure data protection, privacy and copyright requirements are followed * planning the creation of content using project management tools to mitigate potential risks or project delays, for example incorporating project management techniques including scheduling, revision, iteration and evaluation into common collaboration tools to ensure timely delivery of effective solutions * accounting for appropriate project management responsibilities, for example when collaborating with First Nations Australians’ community groups to develop digital solutions to projects: following cultural protocols, including relevant permissions and attributions; acknowledging diversity, capability and strength; and addressing risks and responsibilities such as privacy, security and accuracy of data * incorporating suggestions made by built-in virtual assistants in project planning and organisation tools to streamline and prioritise work; for example, using AI to summarise meeting outcomes, identify important tasks and forecast project risks |
| **Processes and production skills**  Privacy and security | develop cyber security threat models, and explore a software, user or software supply chain vulnerability  AC9TDI10P13 | * using a data flow diagram to understand how private information moves through a system and when it would be the most likely target of a cyber attack, for example mapping how data moves between the user and server when using a web application, and identifying that sending the data in plaintext would make it susceptible to a man-in-the-middle attack * exploring the impact of a cyber security threat by systematically following the steps involved in bypassing a known vulnerability in their own software, for example manually changing the value stored in a login cookie to that of another user to observe the impact of unauthorised access on the system * explaining how techniques like prompt injection can change the intended behaviour of generative AI models; for example, carefully chosen inputs can circumvent any protections or limitations that may have been included in the design of the model |
| **Digital Technologies** | apply the Australian Privacy Principles to critique and manage the digital footprint that existing systems and student solutions collect  AC9TDI10P14 | * critiquing the extent to which online services allow them to control access to their data in line with the Australian Privacy Principles, for example assessing whether their social media accounts allow them to update their contact information if these details change, and who else can see that information on the platform * using the Australian Privacy Principles as a reference to evaluate the steps they are taking to protect user information in their application, for example explaining how they are storing passwords using cryptographic hashing algorithms so that a data breach does not expose their users to security vulnerabilities due to password re-use |
| **Design and Technologies** | **Knowledge and understanding**  Technologies and society | analyse how people in design and technologies occupations consider ethical, security and sustainability factors to innovate and improve products, services and environments  AC9TDE10K01 | * analysing design and technologies professions and their contributions to society, for example engineers working in disaster recovery or empowering communities to improve access to clean, safe energy * recognising the impact of past designed solutions when creating solutions for preferred futures, for example the design of public transport systems that use renewable energy and are accessible, and the design of rural community environments to reduce fire risk * considering the factors that influence design and manufacture, and the work of professional designers, engineers and technologists, including time, access to skills, knowledge, finance, expertise in global engineering and manufacturing, for example Australian designers and engineers working with rapid prototyping manufacturers in a country in Asia or the significance of the collaboration between Australia and Vietnam on the development of the Cao Lanh Bridge * examining mass production systems taking into account ethics and sustainability considerations, for example the mass production of food, clothing and shoes and why manufacturers produce different versions of the same product and support complete product life cycle strategies * explaining the consequences of ethical and sustainability decisions for products, services and environments, for example the accessibility of a managed public environment, the design of roads to include aerial bridges for wildlife and signage powered with solar technologies |
| analyse the impact of innovation, enterprise and emerging technologies on designed solutions for global preferred futures  AC9TDE10K02 | * exploring the ways commercial enterprises respond to the challenges and opportunities of technological change, for example e-commerce, and considering their carbon footprint * investigating scenarios of how the future may unfold and what opportunities and impacts there may be for society and particular groups in a preferred future, for example by using forecasting and backcasting techniques * examining real-world problems and understanding basic needs when considering designed solutions, for example students collaborating to design solutions to challenges in the Asia region; or artists from a country in South-East Asia creating posters for the world to take action in a pandemic |
| **Knowledge and understanding**  Technologies context: Food and fibre production | analyse and make judgements on the ethical, secure and sustainable production and marketing of food and fibre enterprises  AC9TDE10K04 | * examining emerging production technologies and methods in terms of productivity, profitability and sustainability, for example taking account of animal welfare considerations in food and fibre production enterprises, protected cropping, hydroponics or aquaculture * investigating how digital tools could be used to enhance food production systems, for example global positioning systems (GPS) for managing animals, crop sensors, automated animal-feeding or milking systems, or drones for locating and managing weeds |
| **Knowledge and understanding**  Technologies context: Food Specialisations | analyse and make judgements on how the sensory and functional properties of food influence the design and preparation of sustainable food solutions for healthy eating  AC9TDE10K05 | * investigating ways innovations may influence human health and sustainability, for example 3D printing of foods, Internet of Things (IoT) network in the food supply chain or use of augmented reality (AR) in food labelling |
| **Mathematics – Year 9** | **Measurement** | calculate and interpret absolute, relative and percentage errors in measurements, recognising that all measurements are estimates  AC9M9M04 | * investigating how calculating and interpreting absolute, relative and percentage errors in measurements relates to artificial intelligence systems such as regression models, estimating uncertainty and recommendation systems |
| **Statistics** | analyse reports of surveys in digital media and elsewhere for information on how data was obtained to estimate population means and medians  AC9M9ST01 | * exploring how natural language processing (NLP) tools can be used to help analyse large volumes of survey reports in digital media, expediting various processes, and discussing the benefits or limitations of using these tools |
| analyse how different sampling methods can affect the results of surveys and how choice of representation can be used to support a particular point of view  AC9M9ST02 | * exploring potential cultural bias relating to First Nations Australians by critically analysing sampling techniques in statistical reports |
| choose appropriate forms of display or visualisation for a given type of data; justify selections and interpret displays for a given context  AC9M9ST04 | * using digital tools, including generative artificial intelligence, to generate different data displays and visualisations using existing data sets, and discussing which form is more appropriate for the given context |
| **Mathematics – Year 10** | **Measurement** | solve practical problems applying Pythagoras’ theorem and trigonometry of right-angled triangles, including problems involving direction and angles of elevation and depression  AC9M10M03 | * investigating how autonomous vehicles use algorithms that use Pythagoras' theorem and trigonometry to calculate distance and navigate spaces; for example, if an autonomous vehicle knows its current position (x, y) and the coordinates of a target location (x', y'), it can determine the straight-line distance between them using the theorem distance = |
| identify the impact of measurement errors on the accuracy of results in practical contexts  AC9M10M04 | * investigating the impact of measurement errors in the perception and control systems of autonomous vehicles, such as measurement errors due to sensor limitations |
| use mathematical modelling to solve practical problems involving proportion and scaling of objects; formulate problems and interpret solutions in terms of the situation; evaluate and modify models as necessary, and report assumptions, methods and findings  AC9M10M05 | * investigating how artificial intelligence image generators use proportion and scaling techniques, such as aspect ratio preservation, to ensure that the generated content adheres to realistic visual principles and maintains appropriate relationships between objects and elements within the scene |
| **Statistics** | analyse claims, inferences and conclusions of statistical reports in the media, including ethical considerations and identification of potential sources of bias  AC9M10ST01 | * recognising how the identification of bias is a critical aspect of machine learning and deep learning because biases can significantly impact the fairness, accuracy and ethical implications of artificial intelligence systems |
| compare data distributions for continuous numerical variables using appropriate data displays including boxplots; discuss the shapes of these distributions in terms of centre, spread, shape and outliers in the context of the data  AC9M10ST02 |  |
| **Probability** | design and conduct repeated chance experiments and simulations using digital tools to model conditional probability and interpret results  AC9M10P02 | * using simulation to predict the number of people likely to be infected with a strain of flu or virus |
| **Science – Year 9** | **Science inquiry**  Planning and conducting | select and use equipment to generate and record data with precision to obtain useful sample sizes and replicable data, using digital tools as appropriate  AC9S9I03 | * considering the replicability of data collected using different instruments, including the inaccuracies that may be introduced when taking measurements * discussing the amount of data needed to produce a useful sample size and why sample size is important * considering an appropriate sample size for the investigation, and how the use of digital tools might enable more-efficient data collection for larger sample sizes |
| **Science inquiry**  Processing, modelling and analysing | select and construct appropriate representations, including tables, graphs, descriptive statistics, models and mathematical relationships, to organise and process data and information  AC9S9I04 | * applying algorithms to measure carbon storage of different vegetation types |
| **Science as a human endeavour**  Use and influence of science | examine how the values and needs of society influence the focus of scientific research  AC9S9H04 | * exploring how Australia has developed an artificial intelligence system which is used to predict the likelihood of a viable pregnancy from transfer of a single embryo to a woman undergoing in-vitro fertilisation |
| **Science – Year 10** | **Science inquiry**  Planning and conducting | select and use equipment to generate and record data with precision to obtain useful sample sizes and replicable data, using digital tools as appropriate  AC9S10I03 | * explaining how estimation affects precision and examining the inaccuracy introduced when reading between scale markings * identifying how human error can affect replicability and reproducibility * deciding how much data is needed to produce valid conclusions |
| **Science as a human endeavour**  use and influence of science | examine how the values and needs of society influence the focus of scientific research  AC9S10H04 | * considering the use of genetic testing for decisions such as genetic counselling, embryo selection, identification of carriers of genetic mutations and the use of this information for personal use or by organisations such as insurance companies or medical facilities * examining the link between scientific research and real-world applications such as space research and new material development |