

Using C# to Develop a Mathematics Quiz

Software Systems Development

Eimhin Laverty

CONTENTS

<i>Contents</i>	1
<i>Background Information</i>	2
<i>User Requirements (MoSCoW)</i>	3
<i>Contract</i>	4
<i>Design Plans</i>	5
<i>Developer Plans</i>	8
<i>Form Navigation Map</i>	17
<i>Diary of Events</i>	18
<i>Tests</i>	24
<i>Test Evidence</i>	38
<i>Application Screenshots</i>	52
<i>End User Questionnaire</i>	57
<i>Evaluation</i>	58

BACKGROUND INFORMATION

For my Software Systems Development coursework, I have been specified to develop a quiz based application. For this, I decided to opt for a maths based quiz contracted on behalf of my mathematics teacher for Year 13 students undertaking the AS Maths course. As part of the task, they wish for the application to be interactive and fun to encourage students to play it but also challenging enough to engage the student to actively utilise their mathematical abilities. In addition, they would also like for the application to be as aesthetically pleasing as possible as a means of making the students perceive the application as being professional and well designed. In order to ensure students are properly using the application, they requested that a profile system be implemented in which a student can make their own unique profile which will record the games played, total score, average score and also provide them with the facility to choose a unique avatar. Furthermore, the teacher wants there to be a variety of questions in order to accurately test the student's mathematical ability, each of which is presented with multiple possible answers and presented in different ways in order to keep the student interested in the quiz. As a means of encouraging the student to think fast and carefully delegate their time, a timer is also requested to be implemented for the quiz, in which the student must finish the quiz in time or else the game ends, as a means of replicating the conditions they will face in the real examination.

USER REQUIREMENTS (MoSCoW)

Must Have:

- **Types of Questions**
 - Radio button based question
 - Drag and drop based question
 - Textbox input question
 - Checkbox based question
- Selection of answers for each question
- Easy to use interface
- **Scoring System**
 - Add 1 to score if question is right
 - No change to score if question is wrong
 - Add 1 to score if all questions right
 - Add score at end of game to total score for all games
 - Create new average score

Should Have:

- Error checking/Validation
- User feedback
- Aesthetically pleasing design
- **Profile System**
 - Maximum number of profiles
 - Ability to create and reset profile
 - Password enabled profiles
 - Statistics in profile including: name, games played, average score
 - Unique avatar

Could Have:

- Leader board with top scores
- Larger number of questions

Won't Have:

- Randomly generated questions with answers

CONTRACT

By signing this contract, I the client agree to the guidelines outlined in this document of which I have confirmed as the requirements for the development of the application to be built by the developer. I agree to refrain from interfering with the developer and allowing them to independently build the application.

Client Signature

Date

.....
Developer Signature

.....
Date

DESIGN PLANS

Software Coursework Plan

Start Form

1,2 = Profile 1 and 2
+ = New profile menu shows up when button clicked
If profile has pass code enabled, "Enter Password" and textbox become visible

+ New Profile Name	Profile Picture
Red Green Purple	Blue Orange Black

Enter Password Select A Profile 1 2 +

Main Menu Form

New Game Picture Help Edit Profile

Profile Information
Name: Player
Games Played: 3
Total Points: 12
Av. Points/ Game: 4

Question 1

Differentiate $y = 6x^2 - 42 + x$ Points 15

$\frac{dy}{dx} = 12x^3 + 1$ $\frac{dy}{dx} = 36x - 42$

$\frac{dy}{dx} = 12x + 1$ $\frac{dy}{dx} = 8x + x^2$

For all questions
If question right: add one to points and messagebox show saying "Correct!"
If question wrong: messagebox show saying "Wrong".

NEXT PAGE

Question 2

Answer: $x = 4$
 $x = 3$

Checkboxes

Question 3

Answers: $\sqrt{180} = 6\sqrt{5}$
 $\sqrt{75} = 5\sqrt{3}$
 $\sqrt{98} = 7\sqrt{2}$

Drag and drop

Question 4

Answer: 0.0000026

□ = Drop down box
 Content:
 - 26000000
 - 0.000000026
 - 260000000
 - 0.00000026

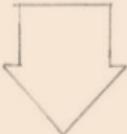
The number 2.6×10^{-7} can be written as

Points 15

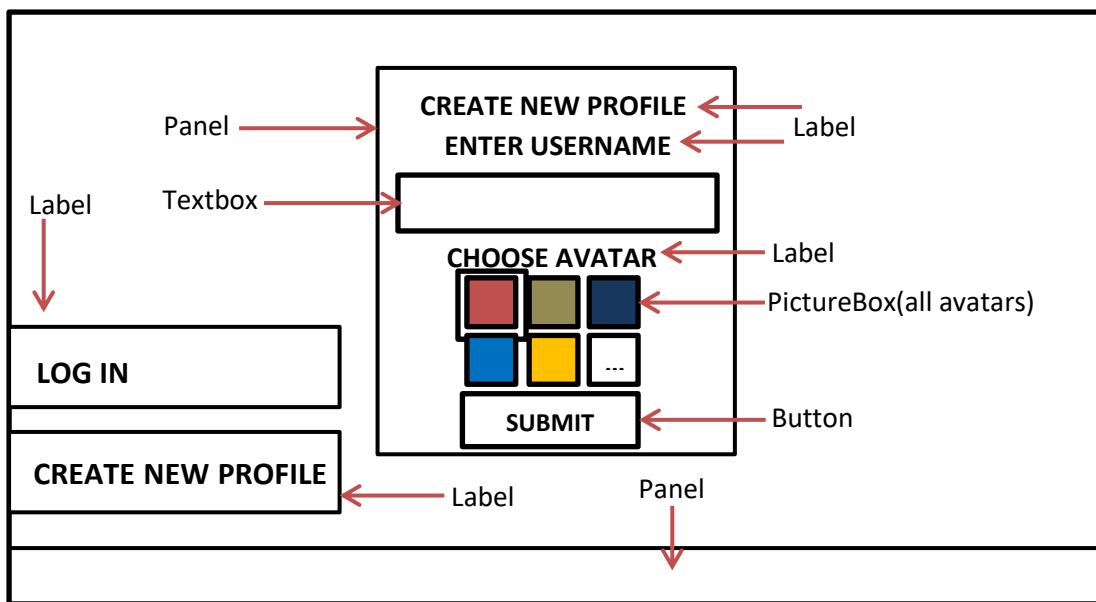
Select an answer:

Submit

NEXT PAGE

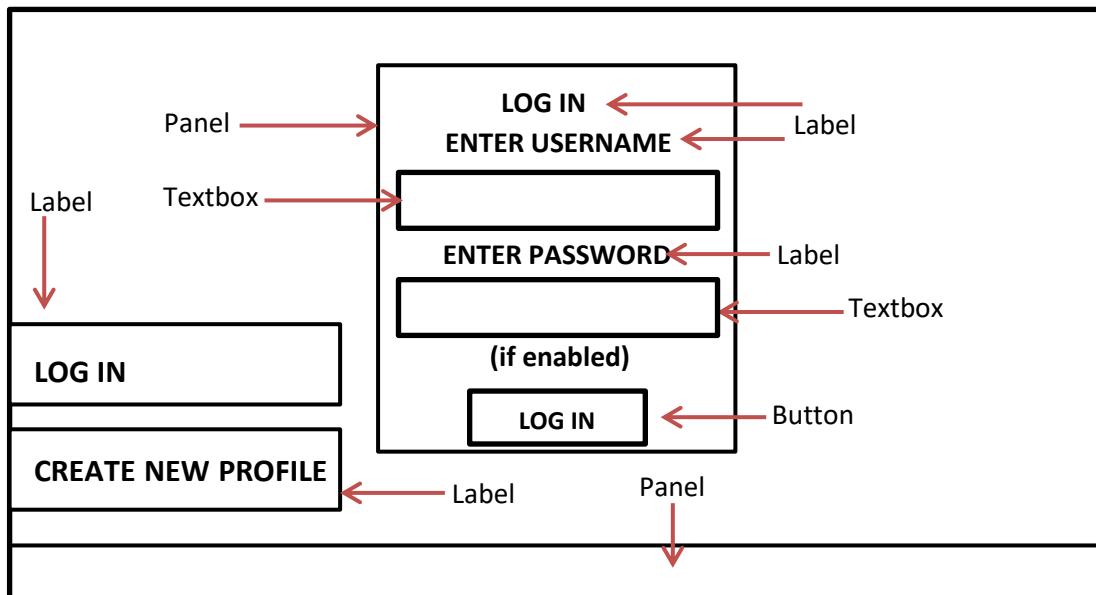
<p>Find the equation of the tangent to the curve $y = -x^3 + 6x^2 - 5x$</p> <p>$y = \boxed{\quad} - \boxed{\quad}$</p> <p><input type="button" value="Submit"/></p> <p><input type="button" value="Home"/></p>	<p><u>Question 5 - New form</u></p> <p>Answer: $y = 4x - 4$</p> <p>Textboxes</p>
	
<p>Game Complete!</p> <p>You scored X/5</p> <p><input type="button" value="Play again"/></p> <p><input type="button" value="Main Menu"/></p> <p><input type="button" value="Home"/></p>	<p><u>Game Finished - New form</u></p> <p>$X = \text{PlayerScore}$</p>
<p>Edit Profile</p> <p>Name <input type="text"/></p> <p>Picture <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/></p> <p>Password <input type="password"/></p> <p><input type="button" value="Home"/></p>	<p><u>Edit Profile - New form</u></p> <p>Shows when Edit Profile button on main menu clicked</p>
<p>Help</p> <p>To return to main menu, click the home button at the bottom right. To play a game, click the New Game button on the main menu. To edit your profile, click the Edit Profile button on the main menu.</p> <p><input type="button" value="Home"/></p>	<p><u>Help - New form</u></p> <p>Help info</p>

DEVELOPER PLANS

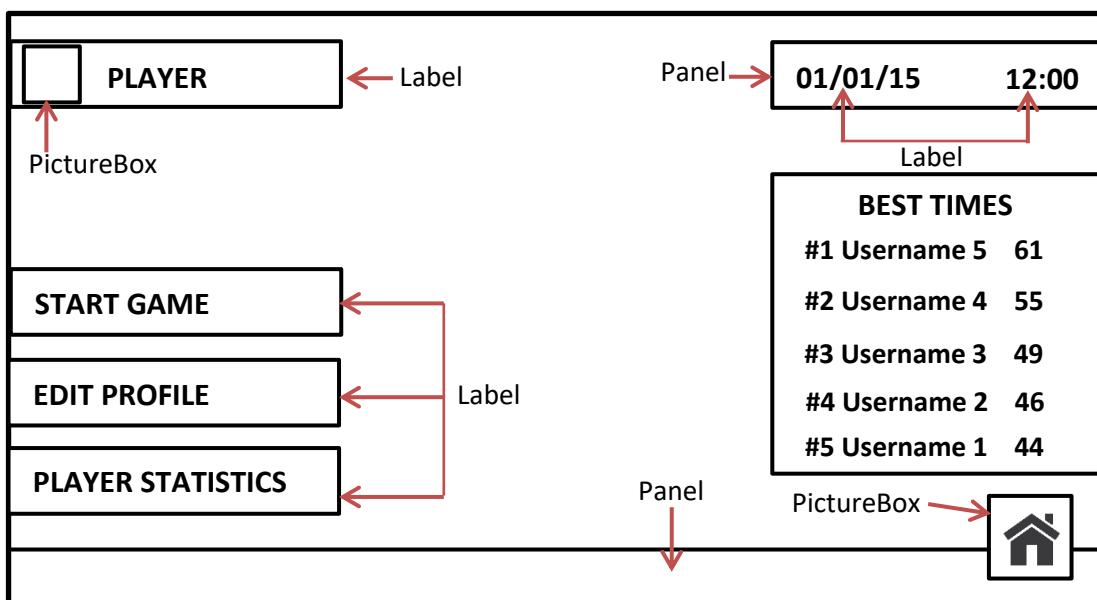


Start Menu – Create New Profile

- '0' and '75' written to Score.txt and Time.txt respectively using StreamWriter
- ProfileInfo.txt read into form using StreamReader and information stored in instances of the Profile class
- Click event raised on 'Create New Profile' label: 'Create New Profile' panel Visible property set to True. 'Log In' panel Visible property set to False
- Click event raised on 'Log In' label: 'Create New Profile' panel Visible property set to True. 'Log In' panel Visible property set to False
- Username entered in textbox
- Click event raised on an avatar PictureBox: Sets location of background PictureBox (behind red avatar) to that of the selected avatar's location, minus 4 from the x and y coordinates.
- Double Click event raised on ellipsis avatar: Opens up RGB colour chooser¹ allowing the user to pick a custom colour instead of one of the pre-set choices
- Click event raised on 'Submit' button: Using StreamWriter a new profile is written to ProfileInfo.txt after validating that the username hasn't been used. If it has, a MessageBox will appear asking the user to enter a new username. Once all conditions are met, moves to Main_Menu form

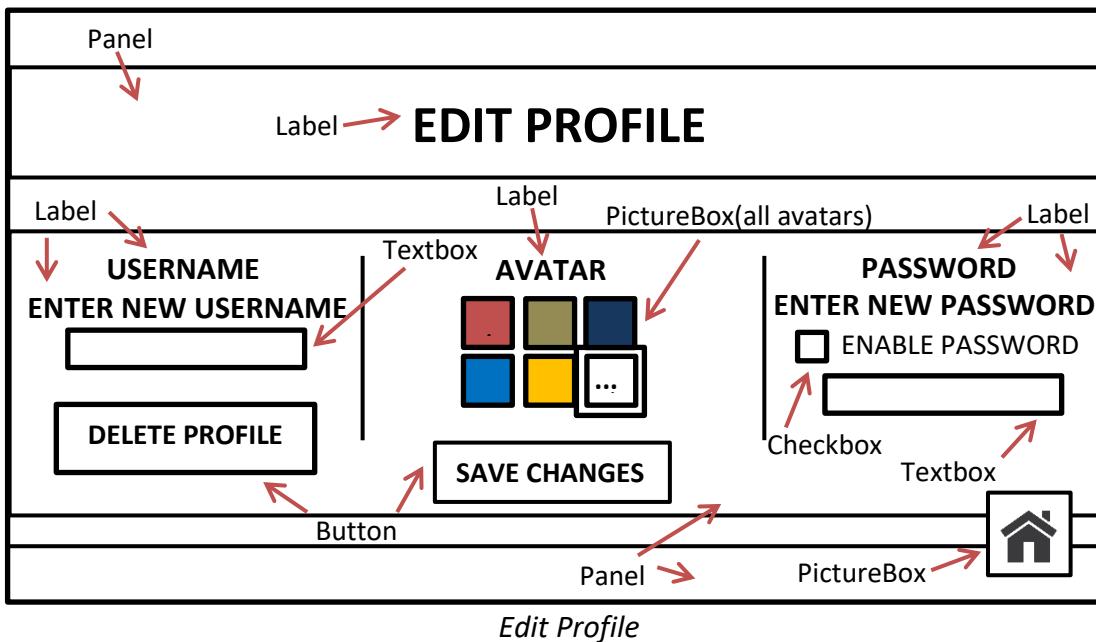
*Start Menu – Log In*

- Username entered in username textbox
- Password entered in password textbox
- Click event raised on 'Log In' button: Checks username and/or password entered by cross referencing the textbox Text with Username and Password variables within the Profile classes created when ProfileInfo.txt was read in. If either Username or Password returns as incorrect, a MessageBox appears stating so. Once all conditions are met, moves to Main_Menu form

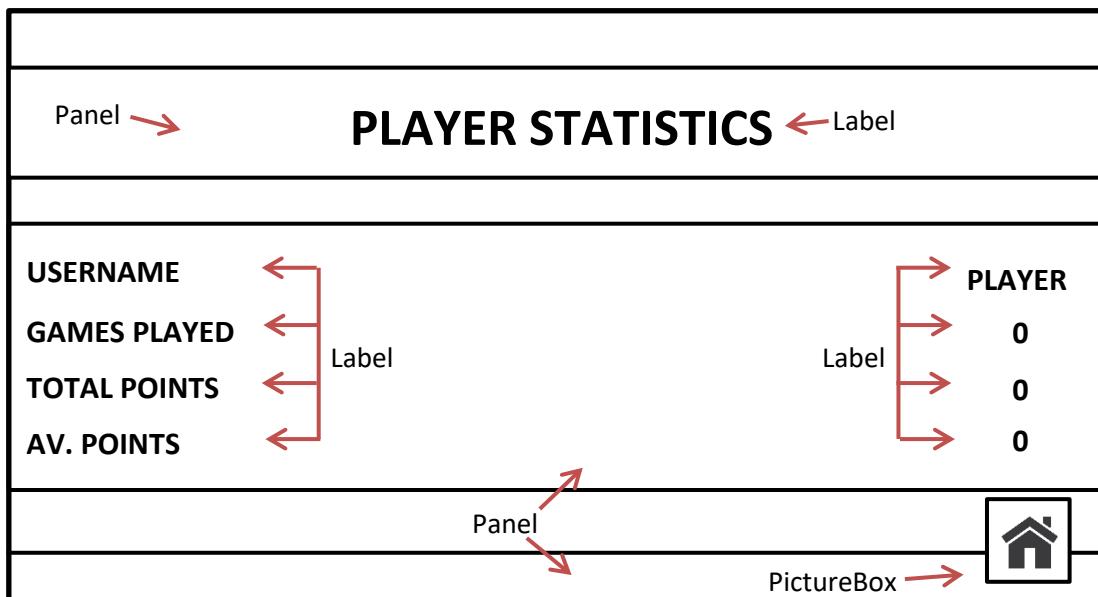
*Main Menu*

- Player's username set as the Text property of label marked 'Player'
- Avatar set as BackColor of PictureBox beside 'Player'
- Time and date labels updated every second

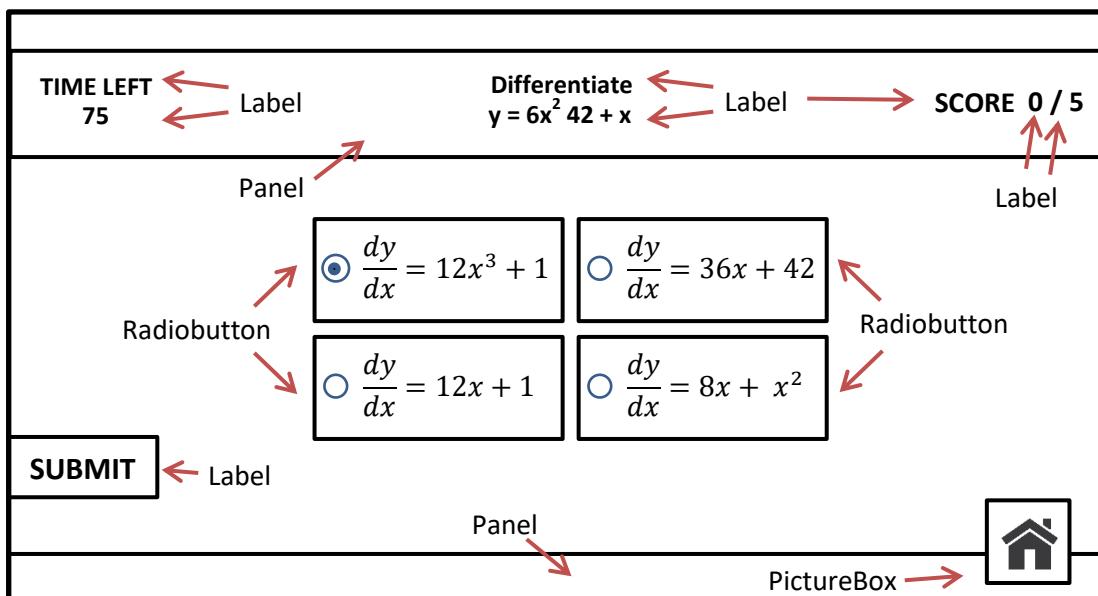
- Click event raised on Help icon (in title bar): Help Menu² panel Visible property set to true
- Click event raised on ‘Start Game’ label: Moves to Question_1 form, starting the quiz
- Click event raised on ‘Edit Profile’ label: Moves to Edit_Profile form
- Click event raised on ‘Player Statistics’ label: Moves to Player_Stats form
- Click event raised on home icon: Moves to Start_Menu form

*Edit Profile*

- ProfileInfo.txt read into form using StreamReader and information stored in instances of the Profile class
- New username entered in Textbox in username section
- New password entered in Textbox in password section. Textbox Enabled property is only set to True if the ‘Enable Password’ checkbox is checked
- Click event raised on an avatar PictureBox: Sets location of background PictureBox (behind red avatar) to that of the selected avatar’s location, minus 4 from the x and y coordinates.
- Double Click event raised on ellipsis avatar: Opens up RGB colour chooser¹ allowing the user to pick a custom colour instead of one of the pre-set choices
- Click event raised on ‘Delete Profile’ button: User is prompted with warning MessageBoxes before confirming profile deletion. If user confirms, profile is completely deleted from ProfileInfo.txt by overwriting the file with each Profile class created except for the selected profile. Then moves to Start_Menu form.
- Click event raised on ‘Save Changes’: Saves any changes made (username, avatar and/or password) to specified Profile class then writes all Profile classes to Profile.txt. Anything that isn’t changed will remain the same as it was previously.
- Click event raised on home icon: Moves to Main_Menu form. Before doing this a MessageBox with Yes No buttons appears asking if the user has saved all changes

*Player Statistics*

- Information retrieved from ProfileSelected.txt using StreamReader
- Information displayed in each corresponding label's Text property
- Click event raised on home icon: Moves to Main_Menu form.

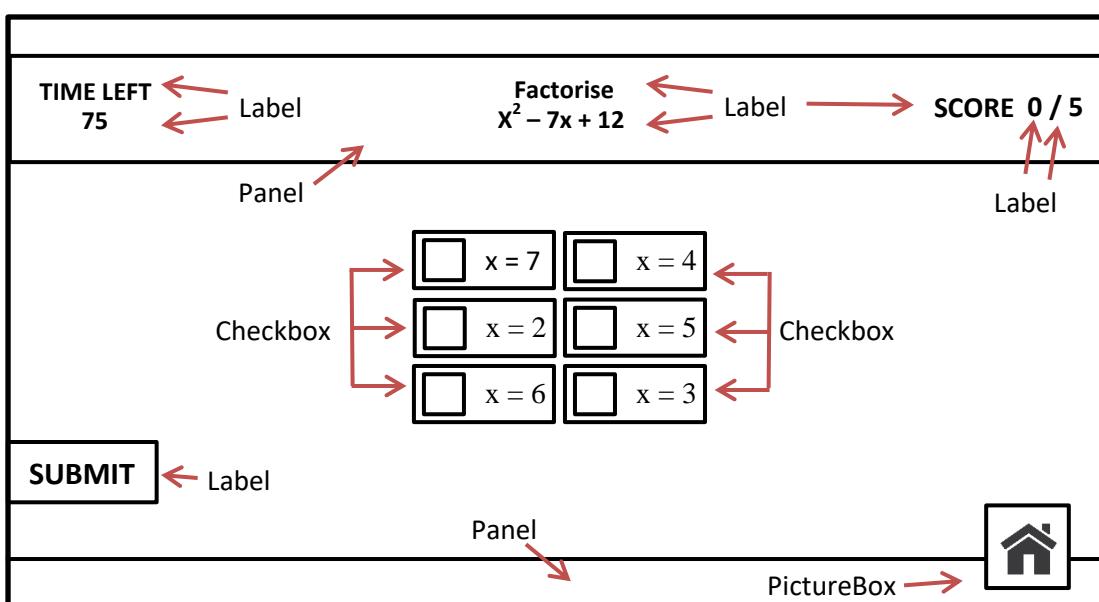
*Question 1**Applies to All Question Forms*

- Each second, the time (represented as 75 here) will decrement by 1 by converting the label Text to an int using Convert.ToInt32(), subtracting 1 then converting back into a string using Convert.ToString() and setting the new string as the Text property of the label. When the time <= 10, the label's ForeColor turns red. Once it reaches zero the form moves to Game_Finished declaring that the user did not finish in time. Any points gained will not be added to the user's profile

- Current score is displayed in the label marked with '0'
- Once an answer has been chosen, raising the click event on 'Submit' label checks the answer then moves onto the next question. If answer is correct, the topmost panel holding the question/time/score will turn green and add 1 to the current score by converting the label's Text property to an int using Convert.ToInt32(), adding 1 then converting back to a string using Convert.ToString(), similar to the method used for the time. If answer is wrong, the panel will turn red and the score will remain the same. The current time when the 'Submit' label's click event is raised and the new score are then written to txt files. Moves onto next form and then the new form reads in the time and score that were written into the txt files to ensure continuous gameplay
- Click event raised on home icon: MessageBox with Yes No buttons shows telling user 'Progress will be lost'. If user selects yes, form moves to Main_Menu form. If no, MessageBox closes and returns to current active form

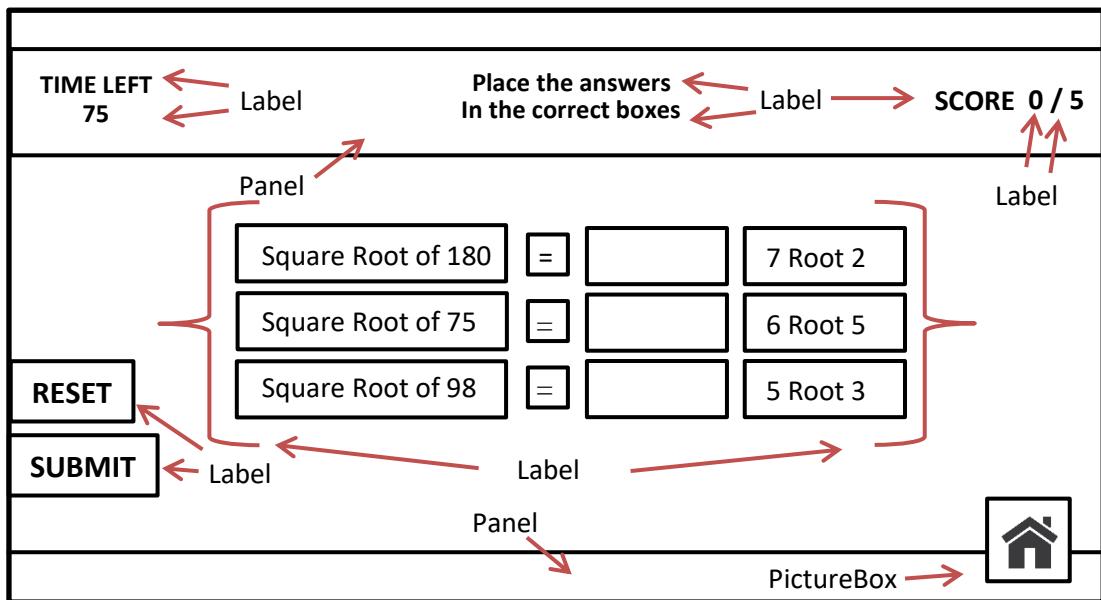
Applies to Question 1 Form

- Answer is chosen by selecting one of the RadioButtons setting Checked property to true. Answer is ' $12x + 1$ '



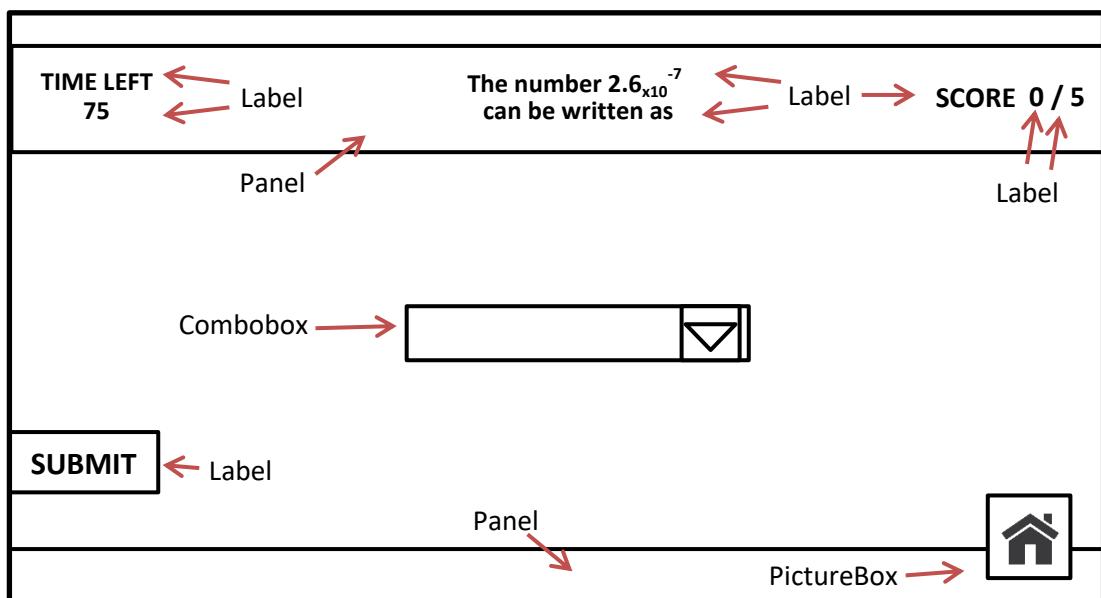
Question 2

- Answer is chosen by clicking checkbox(s), setting Checked property to True. Both 'x = 4' and 'x = 3' must be the only checkboxes selected in order to earn the point



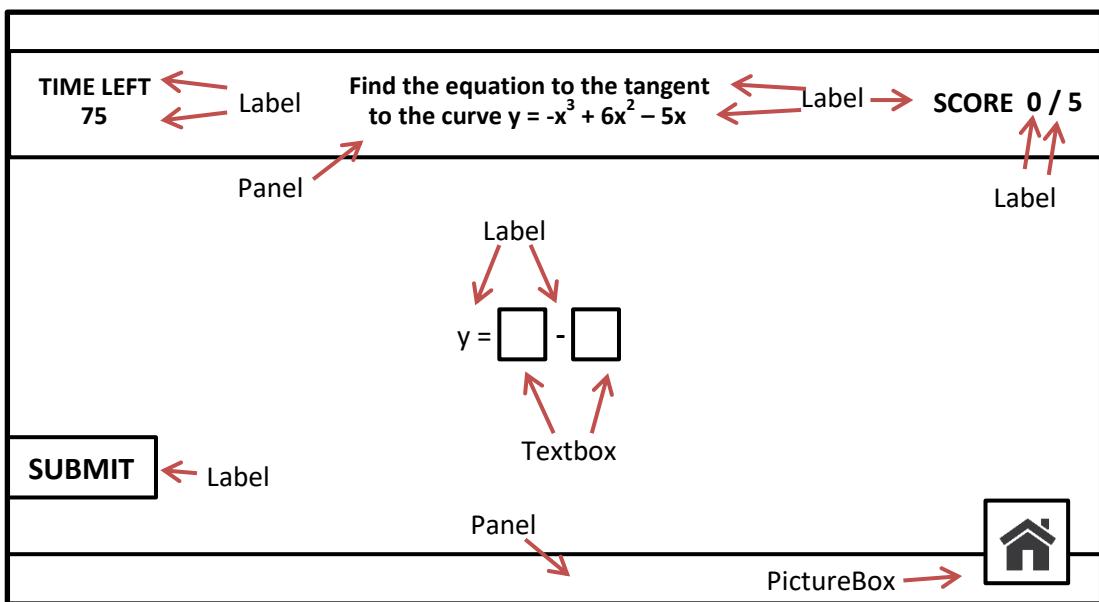
Question 3

- Answers are selected by holding down left mouse button and dragging answer labels into the empty labels. Once dragged in the answer is disabled and can only be moved by raising click event on 'Reset' label.
- Clicking 'Reset': All answers reset to their initial locations and enabled set to true
- Correct answers are 6 Root 5, 5 Root 3 and 7 Root 2 respectively

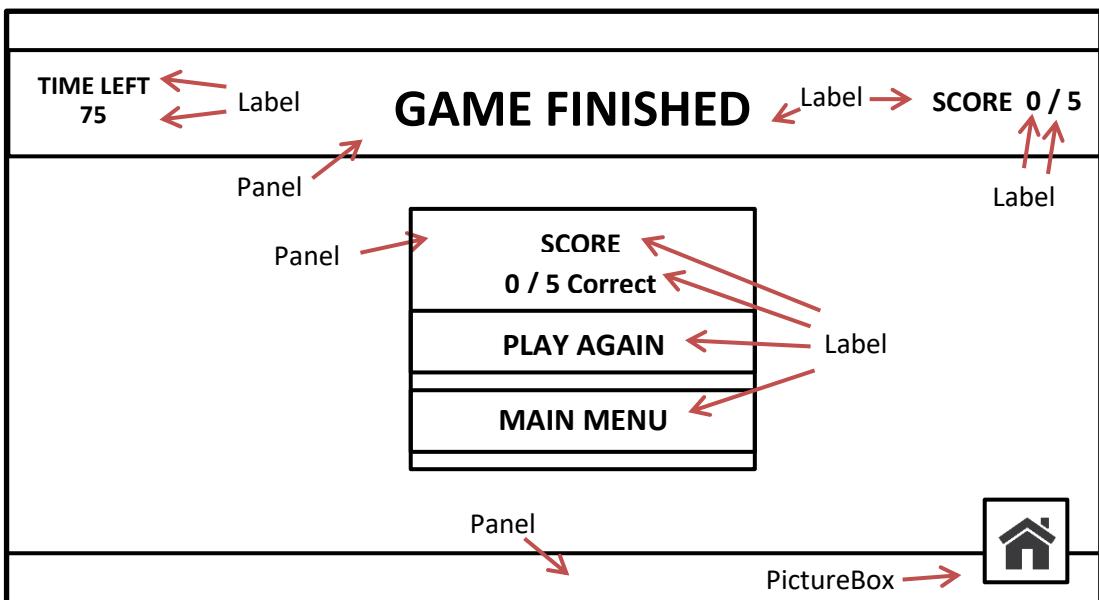


Question 4

- Answer selected from drop down combo box by clicking the arrow. Answer is 0.00000026

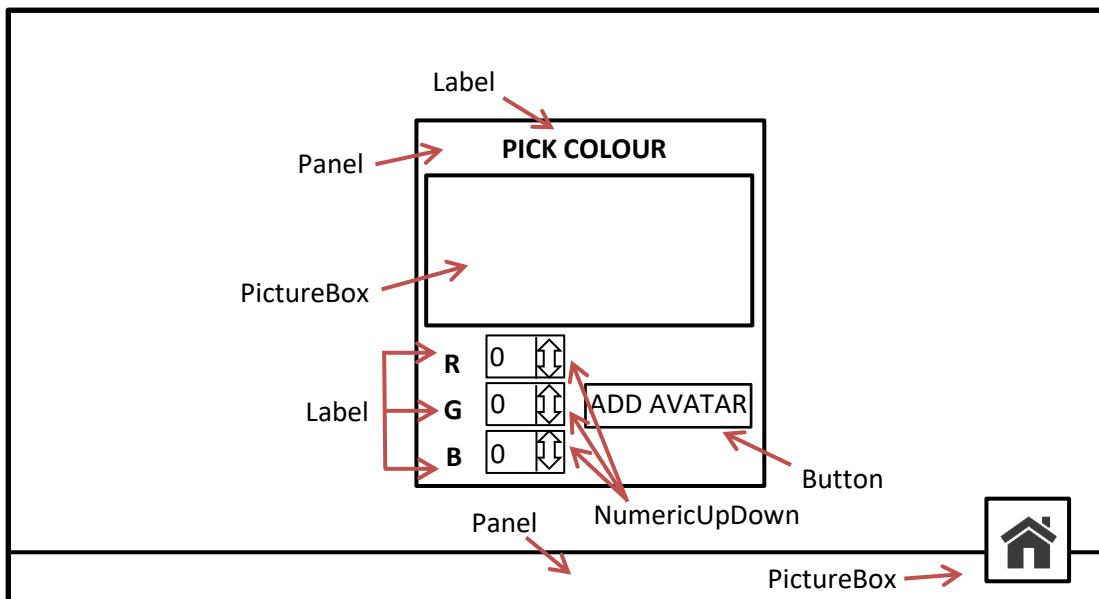
*Question 5*

- First part of equation entered in first textbox e.g. 8x. Second part of equation entered in second textbox e.g. 3
- Answer is 4x(first textbox) – 2(second textbox)

*Game Finished*

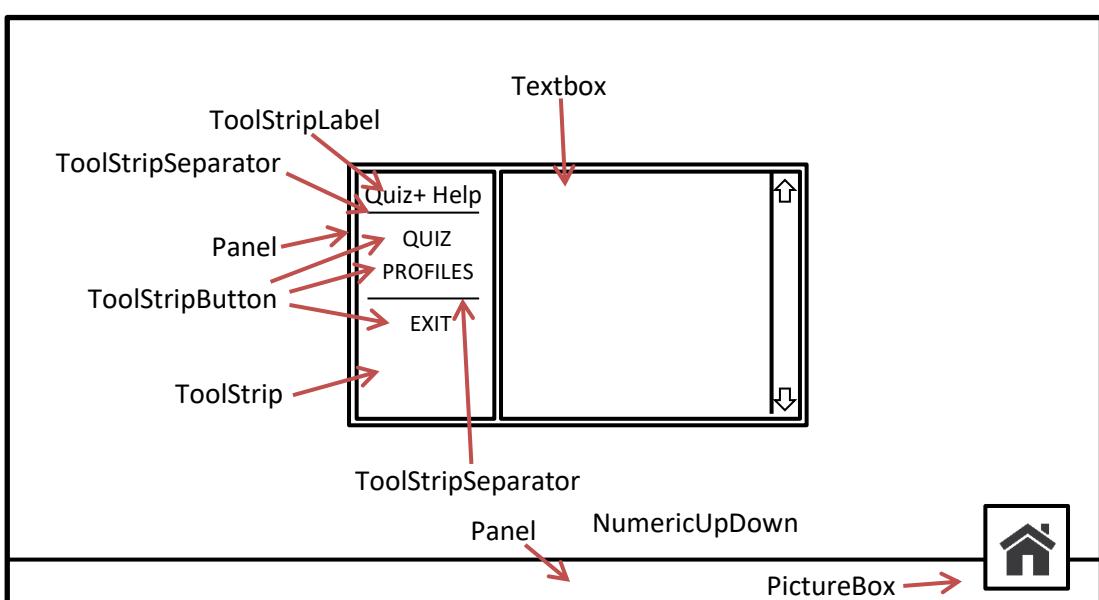
- Score read into form from Score.txt using StreamReader. Text property of '0 / 5 Correct' label set to the correct score by adding together the score string and ' / 5 Correct'
- Click event raised on 'Play Again' label: Returns user to Question_1 form

- Click event raised on 'Main Menu' label: Moves to Main_Menu form



¹ = RGB Colour Chooser

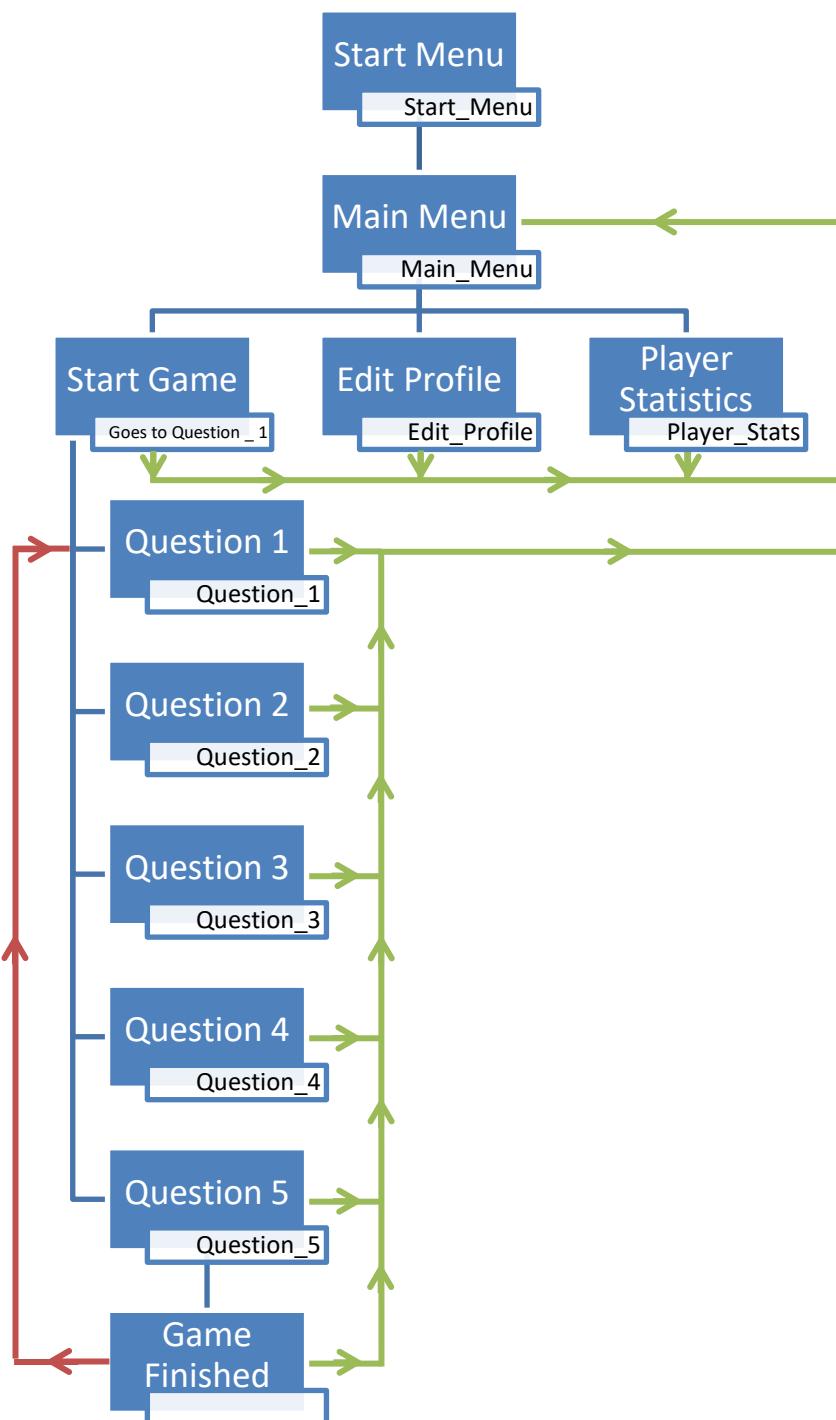
- Displays on both Edit_Profile and Start_Menu when the user invokes a double click event on the custom avatar
- Each 0.010 seconds a timer reads in the value of each numericUpDown control and assigns it to the corresponding int variables (red, green, blue). The variables are then assigned to the FromArgb method creating an RGB based colour which is then set as the BackColor of the PictureBox within the 'Pick Colour' panel
- Click event raised on 'Add Avatar' button: Converts the RGB colour to a hexadecimal value so that it can easily be written to read from the txt file. The avatar selected on the form to display the Colour Chooser's BackColor is set to the chosen colour



² = Help Menu

- Click event raised on ‘Quiz’ button: Textbox Text property set to text regarding quiz
- Click event raised on ‘Profiles’ button: Textbox Text property set to text regarding profiles
- Click event raise on ‘Exit’ button’: Help Menu panel Visible property set to False

FORM NAVIGATION MAP



DIARY OF EVENTS

01/01/15	Started creating forms. Completed 'Start_Menu' form and some of 'Main_Menu'
02/01/15	Finished 'Main_Menu' but after doing so decided to change design of 'Main_Menu' form as the combination of large buttons and pictures doesn't seem to work very well. Instead made each label the same height and moved them all to the left hand side. The pictures were completely removed. However the 'Help' label is placed underneath the profile statistics to the far right of the form
03/01/15	
04/01/15	WEEKEND
05/01/15	Added controls to 'Question_1' form. Found a background that could work well with each form so added to all forms. Copied controls from 'Question_1' form that will be in every Question form (question panel, home icon etc.)
06/01/15	While creating 'Question_1' control layout, encountered issue with not being able to use superscript for the question. To combat this I was required to use multiple labels and place them in such a way as to make it appear as one label when in reality, the question is made up of multiple labels. For the radioButtons, I couldn't create a fraction so I used Paint to create an image of each answer and then used the images in each radiobutton. Finished 'Question_1' control layout
07/01/15	Encountered the same issue as 'Question_1' had in regards to superscript and so used the same method to fix it. Finished 'Question_2' control layout
08/01/15	Finished control layout for 'Question_3'. Decided to change position of 'Submit' button each Question form to the far left side and change it to a label like the ones used on 'Main_Menu'. Also added a 'Submit' label to 'Question_1' (forgot about it in the design plan)
09/01/15	Could not find a drop down box control but after checking MSDN website found that it is called a ComboBox and that the data must be entered by going into the comboBox's properties and clicking the Items property. Continued working on controls by completing layouts of 'Question_4', 'Question_5' and 'Game_Finished' forms. While working on 'Edit_Profile' form, I decided to revamp the layout by having each separate property (name, avatar, password) separated into their own section on the form. Also placed a PictureBox set to DimGray behind each section to improve the aesthetics and fill the form. 'Help' form also created but haven't added anything yet
10/01/15	
11/01/15	WEEKEND
12/01/15	Temporarily added code to the first avatar on 'Start_Menu' to go to 'Main_Menu' form until I implement a proper system for logging in and creating profiles. In 'Main_Menu' added functionality to labels so when clicked, 'New Game' goes to 'Question_1' form, 'Edit Profile' label goes to 'Edit_Profile' form and 'Help' goes to 'Help' form.
13/01/15	Creating a MouseOver event for 'Main_Menu' form's labels so that when the mouse hovers over a label, the label turns to a lighter shade of grey. Also created a MouseLeave event too to turn the label back to the original darker shade of grey. Added the code needed to get 'Question_1' form to work. Not sure how to work points yet but will figure out later
14/01/15	
15/01/15	
16/01/15	
17/01/15	HOLIDAY

18/01/15	HOLIDAY
19/01/15	
20/01/15	
21/01/15	MOCKS
22/01/15	
23/01/15	OPEN DAY
24/01/15	
25/01/15	WEEKEND
26/01/15	Completed code for 'Question_2' form. Decided to skip 'Question_3' as it involves using drag and drop which I haven't researched into doing yet. Continued on by coding 'Question_4'.
27/01/15	
28/01/15	Added code for 'Question_5'. Also used MouseOver/MouseLeave code used in 'Main_Menu' for each 'Submit' label in all the Question forms
29/01/15	In 'Game_Finished', made each label functional so that when the user clicks 'Play Again' they are moved to 'Question_1' form or if they click 'Main Menu' label, they will be moved to 'Main_Menu' form
30/01/15	
31/01/15	
01/02/15	WEEKEND
02/02/15	Discovered issue in 'Question_2' in which by selecting the 2 correct answers and any other answers, it is still regarded as correct. This was due to the if statement in the code which stated only that chkAns4 and chkAns6 need to be checked. To fix this, I added that each other chkAns's Checked property must be set to false as well. I also decided to do a complete revamp of the design of 'Start_Menu' by removing everything and starting from scratch. First I added two labels, 'Log In' and 'Create A Profile' with similar design to the labels used in 'Main_Menu' to the left hand side of the form. When clicked, the label will show a panel respective to what it is so clicking 'Log In' label shows the 'Log In' panel. In the 'Log In' panel I added 2 textboxes, username and password and a 'Log In' button. The 'Create A Profile' panel is for the most part the same except it also has a 'Submit' button now. Will work on coding once I've found out how to get profiles working.
03/02/15	Researched ways in saving data so that a score can be passed through each form. Found a way of using text files and a StreamReader/StreamWriter method to read and write the text file. This way the score can be passed through each form. The same method could also be used to develop profiles. Started writing code to implement this system in 'Question_1' form.
04/02/15	Continued working on getting the score working by reusing the same code for reading and writing in each form. Score successfully passed into each form.
05/02/15	
06/02/15	Removed MessageBox in each Question form for when you hit 'Submit' so that instead, the question panel and all the control's inside it's BackColor change colour according to whether you answered correctly or incorrectly. When correct everything turns green while when incorrect, everything turns red. Applied this to all Question forms
07/02/15	
08/02/15	WEEKEND
09/02/15	Testing out ways of getting profiles to function. Found that the most effective method is to place all data into a single text file and when assign each line read, to a string

	variable.
10/02/15	Began implementation of profile system. Created text file in which the first line is the number of profile and every 6 lines is one profile (where each line corresponds with a property; Username, Password, Avatar, GamesPlayed, TotalPoints, AveragePoints). First line (profileAmount) is used for the expression of a for loop which reads in the information from the text file and assigns it to separate arrays which correspond with each property.
11/02/15	Manged to get 'Log In' functioning. Created another text file for storing the currently selected profile by writing the array the profile information was assigned to, to ProfileSelected.txt
12/02/15	Now working on getting profile creation working.
13/02/15	Encountered problems with writing to files in which it keeps wiping the file but eventually solved the issues and was able to get it to function
14/02/15	MID TERM BREAK
15/02/15	Did more work on profiles. Added validation to creating a profile to prevent users from using the same username. Also removed player information from 'Main_Menu' form and created a separate form called 'Player_Statistics' for profile information. Using ProfileSelected.txt information is easily read in and displayed in 'Player_Statistics'. With profiles working also started working on code for 'Edit_Profile'. To ensure that the correct profile was edited, in 'Start_Menu', I added the profileDimension variable (which is used to determine which profile is in use) to ProfileSelected.txt. This way when the profiles are read into 'Edit_Profile', the profileDimension of the current profile can be read in from ProfileSelected.txt and used to select the correct index of each array containing profile information. Because of this the properties can be easily edited and then, writing the information back simply involves writing back the arrays to ProfileInfo.txt
18/02/15	Added code to 'Game_Finished' to update GamesPlayed, TotalPoints and AveragePoints when a game is finished. Also began implementation of a timer by following the same principles used to get the score to pass through each form to create a challenge for the user
19/02/15	
20/02/15	Successfully got timer to function throughout each Question form. Made it so that when time reaches '10', the color of lblTime (same on each Question form) turns red. When time reaches '0', moves to 'Game_Finished' form and score is not saved. There is a slight delay in the time appearing when moving from form to form so will look into this later. Made minor adjustments to the design of 'Game_Finished'.
21/02/15	WEEKEND
22/02/15	
23/02/15	Built profile class to negate the need for multiple arrays within 'Start_Menu' and was able to get log in working successfully using the new system
24/02/15	Moved onto creating a new profile which also works with the new system too. Due to limited selection of avatars, implemented an RGB colour picker to allow the user to choose their own custom colour.
25/02/15	Trying to figure out way to convert the avatar colour into a string (to be written into the profile text file) then back into a colour (when the profile is selected).
26/02/15	Found out that by converting the colour into a hexadecimal colour code using the ColourTranslator.ToHTML method a string can be generated which can then be converted back into a colour using NumberStyles.HexNumber
27/02/15	Added validation to ensure that a new profile cannot use an existing username. New profile is written to the ProfileInfo.txt file.

28/02/15	When new profile/log in occurs, the chosen profile is written to the ProfileSelected.txt so it the data can be easily accessed when viewing and editing properties. Added functionality to 'Edit Profile'. All aspects work as intended. Also reused the RGB selector from 'Start Menu' profile creation within 'Edit Profile'. Need to check that validation functions properly later. Added help menu to 'Main Menu' which is accessed by pressing the helper provider button. Also added a message for when a new profile is created which shows players the help menu automatically.
01/03/15	Encountered problem with incorrect username being overwritten in the ProfileSelected.txt when saving changes in 'Edit Profile'. Found to be a for loop that was set to i < 5 which meant that it ended up reading the average points (6th line of ProfileSelected.txt) rather than the 7th line. Starting to implement profile deletion.
02/03/15	Profiles can now be deleted. Encountered problem with creating a new profile then going to 'Edit Profile' causes application to crash but when you restart and log in with that profile 'Edit Profile' loads perfectly
03/03/15	Resolved previous issue. Scores written to ProfileInfo.txt when game finishes now. Need to double check that average is being calculated properly.
04/03/15	
05/03/15	Working on computer generated plans now.
06/03/15	Still on the plans.
07/03/15	
08/03/15	Plans half done. Need to change 'Edit Profile' username textbox to max character limit of 16.
09/03/15	Finished plans (finally). May need to implement some sort of highscore?
10/03/15	After much trial and error, finally have a best completion time rankings now for the top five times. I tried using a loop for rewriting the array variables that the times are assigned to so that their positions amongst each other can easily be moved but failed to do so and decided to just use multiple if/else if statements instead
11/03/15	Changed date/time method in the timer in 'Main_Menu' into a separate method so it can be called when the form first loads, getting rid of the 0.5 second delay in showing the time when the form is opened.
12/03/15	
13/03/15	Added welcome message when application first loads if there are no profiles made
14/03/15	
15/03/15	
16/03/15	HOLIDAY
17/03/15	
18/03/15	
19/03/15	Fixed issue with application crashing when a new profile is created and the user goes to 'Edit_Profile' form
20/03/15	Adding in comments to code to make it easier to read and understand
21/03/15	Continued with commenting
22/03/15	
23/03/15	Rather than managing score and time throughout quiz using text files and StreamReader/WriterAdded I implemented a 'Question' class for controlling time and score throughout game. In doing so there is less code and it is much less complicated.
24/03/15	'Question' class now completed. Set lblUsername in 'Player_Statistics' to automatically change location so it is aligned asymmetrically with the other statistics
25/03/15	
26/03/15	Changed code for deciding whether help message should display when new profile is

created to function using BinaryWriter rather than StreamWriter. Fixed delay when time shows while changing question form. Removed Minimise+Maximise box in all forms	
27/03/15	Finished commenting
28/03/15	WEEKEND
29/03/15	
30/03/15	Started to conduct testing
31/03/15	Continued testing
01/04/15	Fixed issue with quiz timer continuing and moving to 'Game_Finished' form when player exits mid game to 'Main_Menu'. Need to fix issue with scoring adding even when you leave mid game. Fixed score issue. Started taking screenshots for testing.
02/04/15	
03/04/15	
04/04/15	
05/04/15	
06/04/15	EASTER
07/04/15	
08/04/15	
09/04/15	
10/04/15	
11/04/15	
12/04/15	Added in extra Panel for each answer in Question_3 form. That way when the answer is dragged into the box and disabled, instead of it turning grey the other panel becomes visible and is placed in front of it, allowing the fore color to be retained. The 'cover' panel will then turn invisible if 'Reset Answers' is clicked. Applies for all 3 answers.
13/04/15	Half screenshots completed for testing. Encountered problem with drag and drop answers not resetting to original positions when placed on an occupied spot. Found that the Point value used for resetting position of answer panels in 'Question_3' was set to the coordinates of the label inside the answer panel meaning that the coordinates would be (4,3) rather than for example (385,82). To fix the issue I implemented an if statement within the <code>lblAns_MouseDown</code> event in which a value is retrieved from the label 'Tag' property. Each label's Tag is set 1 or 2 or 3 respectively so that I know which panel the label is within. Then a switch statement is used to set the corresponding Y value to the originalPoint Point by checking the Tag value read in. To prevent the point from continually updating, the whole method is nested within an if statement whose expression is set to false and is only set to true once the <code>lblAns_MouseUp</code> event occurs.
14/04/15	Continued working on screenshots.
15/04/15	Tidied up screenshots.
16/04/15	
17/04/15	Created a form navigation map to add to documentation
18/04/15	Completed testing. Now only need to add test numbers and evidence references.
19/04/15	
20/04/15	WEEKEND
21/04/15	Started adding test numbers to evidence
22/04/15	Continued with numbering. Brought all aspects of documentation together into the one master document
23/04/15	Fixed formatting issues which occurred when creating master document
24/04/15	Added in corresponding test numbers to testing
25/04/15	
26/04/15	WEEKEND

27/04/15	Created an end user questionnaire
28/04/15	Started working on evaluation
29/04/15	Finished off evaluation and polished documentation.

TESTING

Test Number	Test Description	Reason for Test	Expected Outcome	Outcome	Corrective Action	Evidence (page no.)
START_MENU						
1	Load application	Check profile amount is read in properly	When no profiles exist, welcome screen appears upon starting application. If profiles do exist, will display 'Log In' and 'Create A Profile' labels	When no profiles existed, welcome screen appeared. When profiles existed, labels displayed as expected	No corrective action required	38
2	Mouse over 'Log In' or 'Create a Profile' label	Check MouseEnter event functions	Chosen label background turns gray	Chosen label background turned gray in both cases	No corrective action required	38
3	Mouse leave 'Log In' or 'Create a Profile' label	Check MouseLeave event functions	Chosen label background turns dim gray	Chosen label background turned dim gray in both cases	No corrective action required	38
4	Click 'Log In' label	Check Click event functions	'Log In' panel turns visible	'Log In' panel turned visible	No corrective action required	38
5	Click 'Log In' button	Check Click event functions	If username textbox has no text a message appears asking the user to add a username. If username textbox has text, checks to see if the username exists. If so, then checks the password for the assigned profile by cross referencing with what the user inputted into password textbox (no password equals ""). If successful, moves to Main_Menu form else an error message will appear	When no text was present in username textbox, message appeared as expected. When username was entered which doesn't have a password, moved to Main_Menu form as expected. When username was entered an incorrect password, error message displayed	No corrective action required	38

			prompting the user to check username/password			
6	Click 'Create a Profile' label	Check Click event functions	'Create A Profile' panel turns visible	'Create a Profile' panel turned visible	No corrective action required	39
7	Click 'Submit' button in 'New Profile' Panel	Check Click event functions	Checks if username entered in 'txtNewProfileUser' is currently taken by another profile. If not a new profile is created using this username and the selected avatar. Help message displays then moves to Main_Menu form	When existing username was used, error message displayed as expected. When available username was used, help message displayed and moved to Main_Menu form as expected	No corrective action required	39
8	Click an avatar PictureBox	Check Click event functions	'pboxAvatarBack' moves behind the selected avatar and the avatar is set to variable avatar	'pboxAvatarBack' moved behind selected avatar and selected avatar was set accordingly	No corrective action required	39
9	Double click custom avatar PictureBox (ellipsis avatar)	Check DoubleClick event functions	Custom avatar panel appears	Custom avatar panel appeared	No corrective action required	39
10	Type '256' into each numericUpDown control	Check MaxValue is set to 255	Value automatically set to '255'	Value automatically set to '255'	No corrective action required	39
11	Type a value or use arrows on any numericUpDown control	Check custom avatar timer functions	Preview panel (coloured box) changes colour	Preview panel (coloured box) changed colour	No corrective action required	39
12	Click 'Add Avatar' button	Check Click event functions	Custom avatar panel turns invisible and custom avatar PictureBox's back colour is set to the back colour of the preview panel	Custom avatar panel turned invisible and custom avatar PictureBox's back colour set to the back colour of the preview panel	No corrective action required	39
MAIN_MENU						
13	Load form	Check form Load event	Correct best times with usernames	Correct best times with	No corrective action required	39

		functions	shown in best times panel. Current date and time shown at top right corner of form. Selected profile's avatar and username shown at top left corner of form. If a new profile was created in the previous form and 'yes' was selected in the help message option, help panel will display (See Test 21)	usernames showed in best No corrective action required times panel. Current date and time showed at top right corner of form. Selected profile's avatar and username showed at top left corner of form. If a new profile was created in the previous form and 'Yes' was selected in the help message option, help panel displayed (See Test 21 for help panel)		
14	Timer	Check timer Tick event functions	Time displayed in top left of form should update in real time	Time displayed in top left of form should updated in real time	No corrective action required	39
15	Mouse over 'Start Game', 'Edit Profile' or 'Player Statistics' label	Check MouseEnter event functions	Label background turns gray	Label background turned gray	No corrective action required	40
16	Mouse leave 'Start Game', 'Edit Profile' or 'Player Statistics' label	Check MouseLeave event functions	Label background turns dim gray	Label background turned dim gray	No corrective action required	40
17	Click 'Start Game' label	Check Click event functions	Starts quiz by moving to Question_1 form	Quiz started by moving to Question_1 form	No corrective action required	40
18	Click 'Edit Profile' label	Check Click event functions	Moves to Edit_Profile form	Moved to Edit_Profile form	No corrective action required	40
19	Click 'Player Statistics' label	Check Click event functions	Moves to Player_Stats form	Moved to Player_Stats form	No corrective action required	40
20	Click home icon	Check Click event functions	Moves to Start_Menu	Moved to Start_Menu	No corrective action required	40
21	Click help icon	Check Click	Shows 'Help' menu	Showed 'Help'	No corrective	40

		event functions		menu	action required	
22	In Help menu: click 'Quiz'	Check Click event functions	Quiz related help appears in help textbox	Quiz related help appeared in help textbox	No corrective action required	41
23	In Help menu: click 'Profiles'	Check Click event functions	Profile related help appears in help textbox	Profile related help appeared in help textbox	No corrective action required	41
24	In Help menu: click 'Exit'	Check Click event functions	Help menu turns invisible	Help menu turned invisible	No corrective action required	41

EDIT_PROFILE

25	Load form	Check form Load event functions	If current profile has a password, 'Enable Password' checkBox set to checked and password displayed in password textbox. Current profile's avatar set to back colour of custom avatar PictureBox	If current profile has a password, 'Enable Password' checkBox set to checked and password displayed in password textbox. Current profile's avatar set to back colour of custom avatar PictureBox	No corrective action required	41
26	Click an avatar PictureBox	Check Click event functions	'pboxAvatarBack' moves behind the selected avatar and the avatar is set to variable avatar. If successful, moves to Main_Menu form	'pboxAvatarBack' moved behind selected avatar and selected avatar was set accordingly	No corrective action required	41
27	Double click custom avatar PictureBox (ellipsis avatar)	Check DoubleClick event functions	Custom avatar panel appears	Custom avatar panel appeared	No corrective action required	41
28	Type '256' into each numericUpDown control	Check MaxValue is set to 255	Value automatically set to '255'	Value automatically set to '255'	No corrective action required	41
29	Type a value or use arrows on any numericUpDown control	Check custom avatar timer functions	Preview panel (coloured box) changes colour	Preview panel (coloured box) changed colour	No corrective action required	41
30	Click 'Add Avatar' button	Check Click event functions	Custom avatar panel turns invisible and custom avatar PictureBox's back	Custom avatar panel turned invisible and custom avatar	No corrective action required	42

			colour is set to the back colour of the preview panel	PictureBox's back colour set to the back colour of the preview panel		
31	Click 'Save Changes' button	Check Click event functions	If anything was entered into username textbox, new username is cross referenced against existing usernames to check availability. If available, current profile's username set to new username. Selected avatar PictureBox back colour used as new avatar for current profile. If 'Enable Password' unchecked password is removed from profile. If checked, password is set to text entered into password textbox. If no text was entered even though checkbox is checked, error message appears prompting user to enter a password at least 1 character long. If successful, message saying "Changes Saved" will appear	All functions worked as expected	No corrective action required	42
32	Click 'Delete Profile' button	Check Click event functions	Message appears asking if user is sure they want to delete profile. If they click 'Yes', another message appears confirming the decision. If they click 'Yes' again, a message shows	Message appeared asking if user is sure they want to delete profile. When 'Yes' clicked, another message appeared confirming the	No corrective action required	42

			stating that the profile has been deleted and the user will be returned to the Start Menu. If 'No' is ever clicked, message will simply vanish and return to Edit_Profile	decision. When 'Yes' clicked again, a message showed stating that the profile has been deleted and the user will be returned to the Start Menu which occurred when they clicked 'OK'		
33	Click home icon	Check Click event functions	Message appears asking user if they have saved all changes. If 'Yes' is selected, moves to Main_Menu form. If 'No' is selected message disappears.	Message appeared asking user if they saved all changes. When 'Yes' clicked, moved to Main_Menu form. When 'No' is selected message disappeared.	No corrective action required	42
PLAYER_STATS						
34	Load form	Check form Load event functions	Current profile's username, games played, total points and average points displayed in appropriate labels	Current profile's username, games played, total points and average points displayed in appropriate labels	No corrective action required	43
35	Click home icon	Check Click event functions	Moves to Main_Menu form	Moved to Main_Menu form	No corrective action required	43
QUESTION_1						
36	Load form	Check form Load event functions	Time set to 150. Timer begins counting down in 1 second intervals. Score set to 0.	Time set to 150. Timer began counting down in 1 second intervals. Score set to 0.	No corrective action required	43
37/43	Timer time left	Check Tick event functions	Current time decremented by 1 each second. If time reaches 10, fore colour of time turns red. If time reaches 0, game ends and moves to form	Current time decremented by 1 each second. When time reached 10, fore colour of time turned red. When time	No corrective action required	43/44

			Game_Finished	reached 0, game ended and moved to form Game_Finished		
38	Mouse over 'Submit' label	Check MouseEnter event functions	Label background turns gray	Label background turned gray	No corrective action required	43
39	Mouse leave 'Submit' label	Check MouseLeave event functions	Label background turns dim gray	Label background turned dim gray	No corrective action required	43
40	Click home icon	Check Click event functions	Message appears asking if user is sure they want to exit. If 'Yes' clicked, moves to Main_Menu form. Score is not saved.	Message appeared asking if user is sure they want to exit. When 'Yes' clicked, moved to Main_Menu form. Score was not saved.	No corrective action required	43
41	Click correct radiobutton (12x+1) then click 'Submit'	Check correct answer functions properly	Timer pauses. Question background turns green. Score incremented by 1. After a short pause, moves to Question_2 form	Timer paused. Question background turned green. Score incremented by 1. After a short pause, moved to Question_2 form	No corrective action required	43/44
42	Click incorrect radiobutton then click 'Submit'	Check incorrect answer functions properly	Timer pauses. Question background turns red. Score remains the same. After a short pause, moves to Question_2 form	Timer paused. Question background turned red. Score remained the same. After a short pause, moved to Question_2 form	No corrective action required	44

QUESTION_2

44	Load form	Check form Load event functions	Time passed in from previous question form. Timer begins counting down in 1 second intervals. Score passed in from previous form	Time passed in from previous question form. Timer began counting down in 1 second intervals. Score passed in from previous form successfully	No corrective action required	44/45
45/51	Timer time left	Check Tick	Current time	Current time	No corrective	44

		event functions	decremented by 1 each second. If time reaches 10, foreground colour of time turns red. If time reaches 0, game ends and moves to form Game_Finished	decremented by 1 each second. When time reached 10, foreground colour of time turned red. When time reached 0, game ended and moved to form Game_Finished	action required	
46	Mouse over 'Submit' label	Check MouseEnter event functions	Label background turns gray	Label background turned gray	No corrective action required	44
47	Mouse leave 'Submit' label	Check MouseLeave event functions	Label background turns dim gray	Label background turned dim gray	No corrective action required	44
48	Click home icon	Check Click event functions	Message appears asking if user is sure they want to exit. If 'Yes' clicked, moves to Main_Menu form. Score is not saved.	Message appeared asking if user is sure they want to exit. When 'Yes' clicked, moved to Main_Menu form. Score was not saved.	No corrective action required	44/45
49	Correct checkboxes checked (only x = 4 and x = 3) then click 'Submit' label	Check correct answer functions properly	Timer pauses. Question background turns green. Score incremented by 1. After a short pause, moves to Question_3 form	Timer paused. Question background turned green. Score incremented by 1. After a short pause, moved to Question_3 form	No corrective action required	45
50	Incorrect checkboxes checked (anything other than only x= 4 and x=3 is viewed as incorrect) then click 'Submit' label	Check incorrect answer functions properly	Timer pauses. Question background turns red. Score remains the same. After a short pause, moves to Question_3 form	Timer paused. Question background turned red. Score remained the same. After a short pause, moved to Question_3 form	No corrective action required	45
QUESTION _ 3						
52	Load form	Check form Load event functions	Time passed in from previous question form. Timer begins	Time passed in from previous question form.	No corrective action required	45/47

			counting down in 1 second intervals. Score passed in from previous form	Timer began counting down in 1 second intervals. Score passed in from previous form successfully		
53/63	Timer time left	Check Tick event functions	Current time decremented by 1 each second. If time reaches 10, font colour of time turns red. If time reaches 0, game ends and moves to form Game_Finished	Current time decremented by 1 each second. When time reached 10, font colour of time turned red. When time reached 0, game ended and moved to form Game_Finished	No corrective action required	45
54	Mouse over 'Submit' or 'Reset Answers' label	Check MouseEnter event functions	Label background turns gray	Label background turned gray	No corrective action required	46
55	Mouse leave 'Submit' or 'Reset Answers' label	Check MouseLeave event functions	Label background turns dim gray	Label background turned dim gray	No corrective action required	46
56	Click home icon	Check Click event functions	Message appears asking if user is sure they want to exit. If 'Yes' clicked, moves to Main_Menu form. Score is not saved.	Message appeared asking if user is sure they want to exit. When 'Yes' clicked, moved to Main_Menu form. Score was not saved.	No corrective action required	46
57	Drag and drop an answer label into a box	Check drag and drop functions	Label moves in line with chosen box and disables rendering it immobile.	Label moved in line with chosen box and disabled rendering it immobile.	No corrective action required	46
58	Drag and drop an answer label into an occupied box	Check drag and drop functions	Selected label is returned back to its original position	Selected label moved to top left of form	Found that the Point value used for resetting position of answer panels in 'Question_3' was set to the coordinates of the label inside the answer panel meaning that the	46
59	Drag and drop an answer label to a random position that isn't near or on an occupied box	Check drag and drop functions	Selected label is returned back to its original position	Selected label moved to top left of form	Found that the Point value used for resetting position of answer panels in 'Question_3' was set to the coordinates of the label inside the answer panel meaning that the	46

					coordinates would be (4,3) rather than for example (385,82). To fix the issue I implemented an if statement within the <code>lblAns_MouseDown</code> event in which a value is retrieved from the label 'Tag' property. Each label's Tag is set 1 or 2 or 3 respectively so that I know which panel the label is within. Then a switch statement is used to set the corresponding Y value to the <code>originalPoint</code> Point by checking the Tag value read in. To prevent the point from continually updating, the whole method is nested within an if statement whose expression is set to false and is only set to true once the <code>lblAns_MouseUp</code> event occurs.	
60	Click 'Reset Answers' label	Check Click event functions	All answer labels become enabled and move back to original starting positions	All answer labels enabled and moved back to original starting positions	No corrective action required	47
61	Answer labels in correct order ($6\sqrt{5} \rightarrow 7\sqrt{2} \rightarrow 5\sqrt{3}$ moving downwards) then click 'Submit' label	Check correct answer functions properly	Timer pauses. Question background turns green. Score incremented by 1. After a short pause, moves to Question_4 form	Timer paused. Question background turned green. Score incremented by 1. After a short pause, moved to	No corrective action required	47

				Question_4 form		
62	Answer labels in incorrect order (not 6 root 5 → 7 root 2 → 5 root 3 moving downwards) then click 'Submit' label		Timer pauses. Question background turns red. Score remains the same. After a short pause, moves to Question_4 form	Timer paused. Question background turned red. Score remained the same. After a short pause, moved to Question_4 form		47
QUESTION _ 4						
64	Load form	Check form Load event functions	Time passed in from previous question form. Timer begins counting down in 1 second intervals. Score passed in from previous form.	Time passed in from previous question form. Timer began counting down in 1 second intervals. Score passed in from previous form successfully	No corrective action required	47/49
65/72	Timer time left	Check Tick event functions	Current time decremented by 1 each second. If time reaches 10, fore colour of time turns red. If time reaches 0, game ends and moves to form Game_Finished	Current time decremented by 1 each second. When time reached 10, fore colour of time turned red. When time reached 0, game ended and moved to form Game_Finished	No corrective action required	47
66	Mouse over 'Submit' label	Check MouseEnter event functions	Label background turns gray	Label background turned gray	No corrective action required	48
67	Mouse leave 'Submit' label	Check MouseLeave event functions	Label background turns dim gray	Label background turned dim gray	No corrective action required	48
68	Click home icon	Check Click event functions	Message appears asking if user is sure they want to exit. If 'Yes' clicked, moves to Main_Menu form. Score is not saved.	Message appeared asking if user is sure they want to exit. When 'Yes' clicked, moved to Main_Menu form. Score was not saved.	No corrective action required	48
69	Click comboBox	Check	Drop down list with	Drop down list	No corrective	48

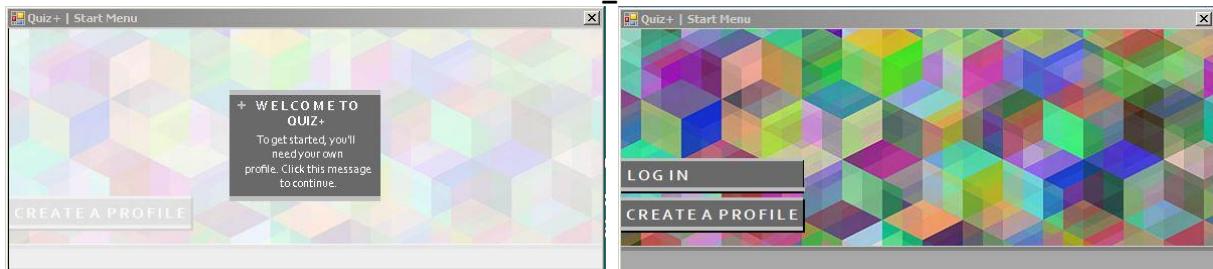
	arrow	combo box drop down list functions	4 choices appears	with 4 choices appeared	action required	
70	Correct answer entered in (0.00000026 in combo box) then Click 'Submit' label	Check correct answer functions properly	Timer pauses. Question background turns green. Score incremented by 1. After a short pause, moves to Question_5 form	Timer paused. Question background turned green. Score incremented by 1. After a short pause, moved to Question_5 form	No corrective action required	48
71	Incorrect answer entered in combobox (not 0.00000026) then click 'Submit' label	Check incorrect answer functions properly	Timer pauses. Question background turns red. Score remains the same. After a short pause, moves to Question_5 form	Timer paused. Question background turned red. Score remained the same. After a short pause, moved to Question_5 form	No corrective action required	48
QUESTION _ 5						
73	Load form	Check form Load event functions	Time passed in from previous question form. Timer begins counting down in 1 second intervals. Score passed in from previous form.	Time passed in from previous question form. Timer began counting down in 1 second intervals. Score passed in from previous form successfully	No corrective action required	49/50
74/80	Timer time left	Check Tick event functions	Current time decremented by 1 each second. If time reaches 10, fore colour of time turns red. If time reaches 0, game ends and moves to form Game_Finished	Current time decremented by 1 each second. When time reached 10, fore colour of time turned red. When time reached 0, game ended and moved to form Game_Finished	No corrective action required	49
75	Mouse over 'Submit' label	Check MouseEnter event functions	Label background turns gray	Label background turned gray	No corrective action required	49
76	Mouse leave 'Submit' label	Check MouseLeave	Label background turns dim gray	Label background	No corrective action required	49

		event functions		turned dim gray		
77	Click home icon	Check Click event functions	Message appears asking if user is sure they want to exit. If 'Yes' clicked, moves to Main_Menu form. Score is not saved.	Message appeared asking if user is sure they want to exit. When 'Yes' clicked, moved to Main_Menu form. Score was not saved.	No corrective action required	49
78	Correct answer entered into each textbox (4X and 2 respectively) then click 'Submit' label	Check correct answer functions properly	Timer pauses. Question background turns green. Score incremented by 1. After a short pause, moves to Game_Finished form	Timer paused. Question background turned green. Score incremented by 1. After a short pause, moved to Game_Finished form	No corrective action required	49/50
79	Incorrect answer entered into either textbox (not 4X and 2 respectively)	Check incorrect answer functions properly	Timer pauses. Question background turns red. Score remains the same. After a short pause, moves to Game_Finished form	Timer paused. Question background turned red. Score remained the same. After a short pause, moved to Game_Finished form	No corrective action required	50
G A M E _ F I N I S H E D						
81	Load form	Check form load functions	Time passed in from previous question form. Score passed in from previous form. Updates current profile info; adds 1 to GamesPlayed, adds points earned to TotalPoints and finds the new AveragePoints. If player earned a score of 5 and their time was better than one of the best times, a message notifying the player will display and it	Time passed in from previous question form. Score passed in from previous form. Updated current profile info; added 1 to GamesPlayed, added points earned to TotalPoints and found the new AveragePoints. When player earned a score of 5 and their time was better than one of the best	No corrective action required	50

			<p>will be added to the Best Times. If player ran out of time during the quiz, the title will say "You Ran Out Of Time" and score will not be saved.</p> <p>GamesPlayed will be incremented by 1 and AveragePoints is recalculated. If player earns any score that wasn't eligible for best time and finished the quiz in time, form loaded and GamesPlayed will increment by 1, points earned will be added to TotalPoints and AveragePoints will be recalculated.</p>	<p>times, a message notifying the player displayed and the new time was added to the Best Times. When player ran out of time during the quiz, the title will say "You Ran Out Of Time" and score will not be saved.</p> <p>GamesPlayed incremented by 1 and AveragePoints was recalculated. When player earned any score that wasn't eligible for best time and finished the quiz in time, form loaded and GamesPlayed incremented by 1, points earned were added to TotalPoints and AveragePoints was recalculated.</p>		
82	Mouse over 'Play Again' or 'Main Menu' label	Check MouseEnter event functions	Label background turns gray	Label background turned gray	No corrective action required	50/51
83	Mouse leave 'Play Again' or 'Main Menu' label	Check MouseLeave event functions	Label background turns dim gray	Label background turned dim gray	No corrective action required	51
84	Click 'Play Again' label	Check Click event functions	Moves to Question_1 form	Moved to Question_1 form	No corrective action required	51
85	Click 'Main Menu' form	Check Click event functions	Moves to Main_Menu form	Moved to Main_Menu form	No corrective action required	51

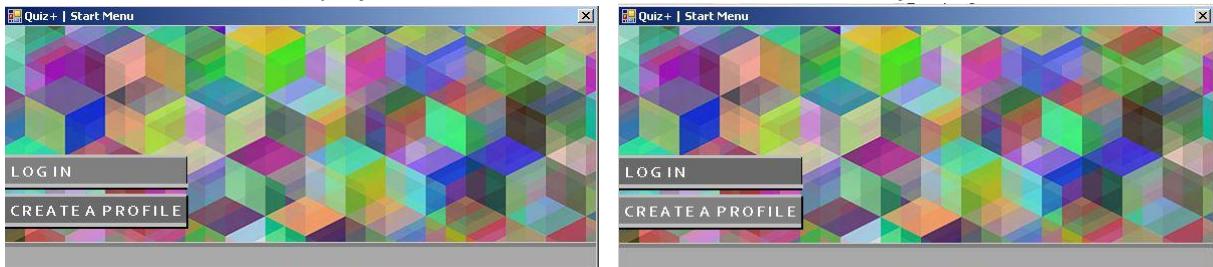
TEST EVIDENCE

START MENU



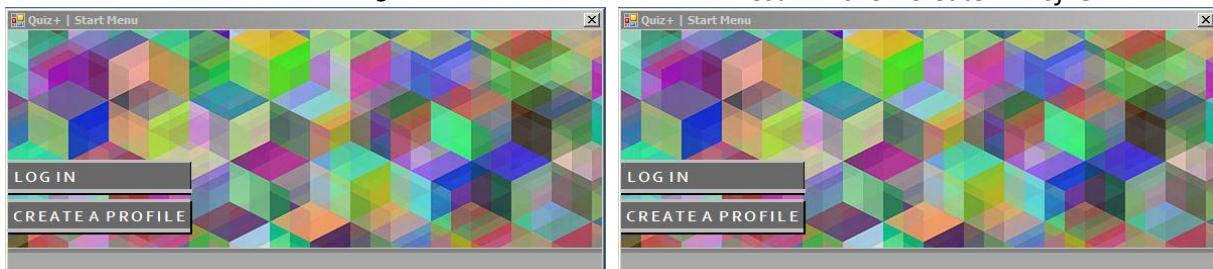
Test 1: No profiles

Test 1: Profiles available



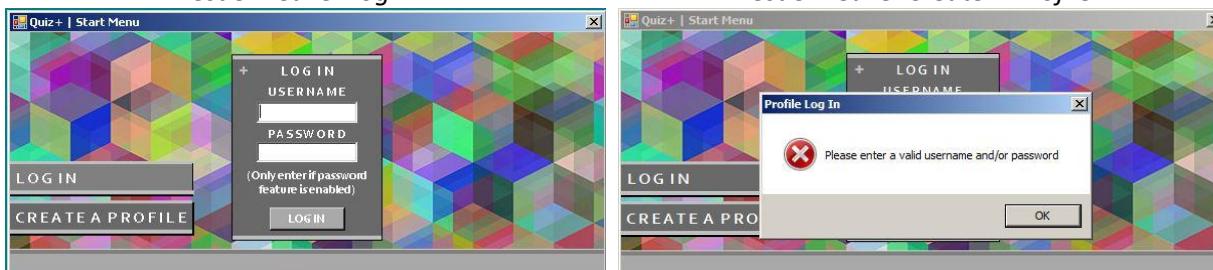
Test 2: Hover 'Log In'

Test 2: Hover 'Create A Profile'



Test 3: Leave 'Log In'

Test 3: Leave 'Create A Profile'



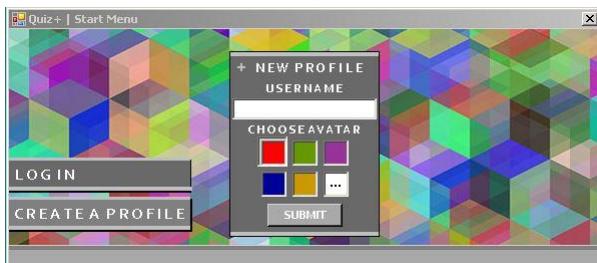
Test 4: Click 'Log In'

Test 5: No username



Test 5: Correct username + no password enabled

Test 5: Correct username + incorrect password



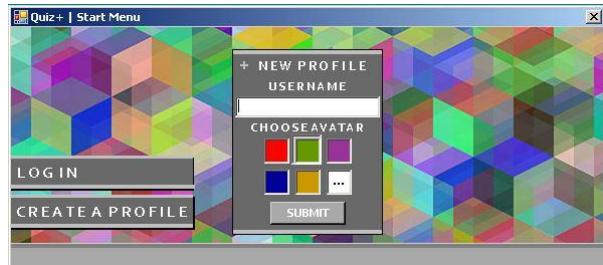
Test 6: Click 'Create A Profile'



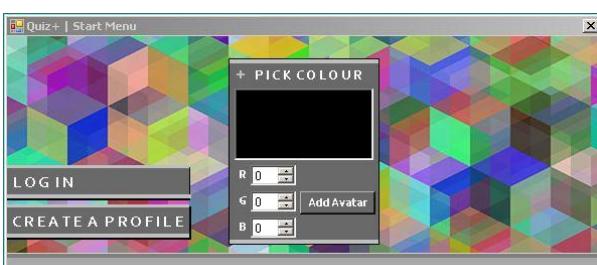
Test 7: Username available



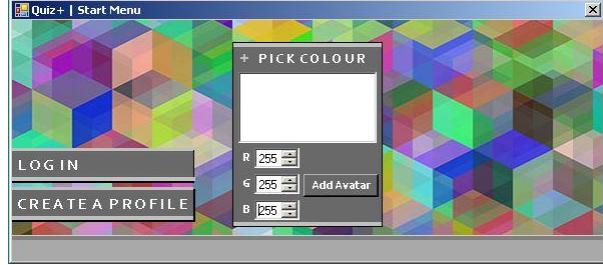
Test 7: Username unavailable



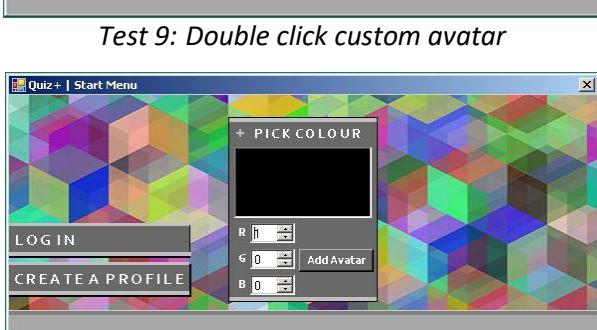
Test 8: Click an avatar



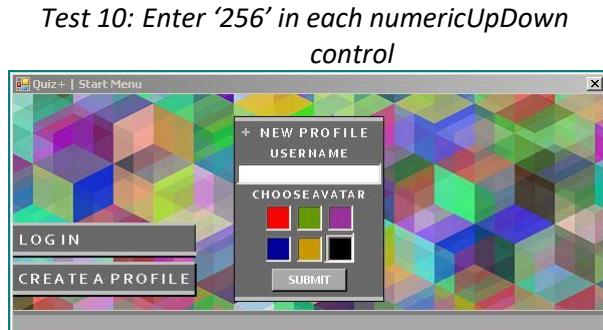
Test 9: Double click custom avatar



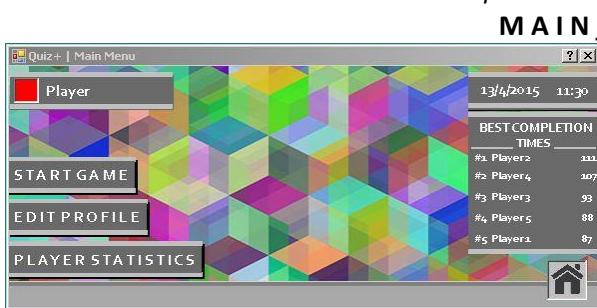
Test 10: Enter '256' in each numericUpDown control



Test 11: Use arrows on each numericUpDown



Test 12: Click 'Add Avatar'



Test 13: Load 'Main_Menu' form



Test 14: Timer



Test 15: Hover 'Start Game'



Test 15: Hover 'Edit Profile'



Test 15: Hover 'Player Statistics'



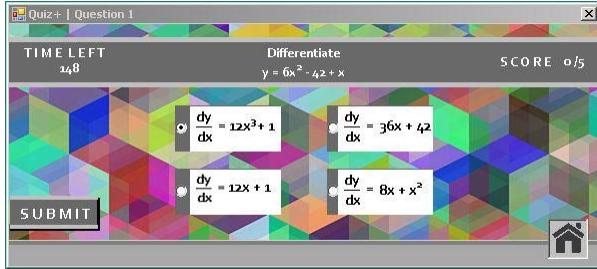
Test 16: Leave 'Start Game'



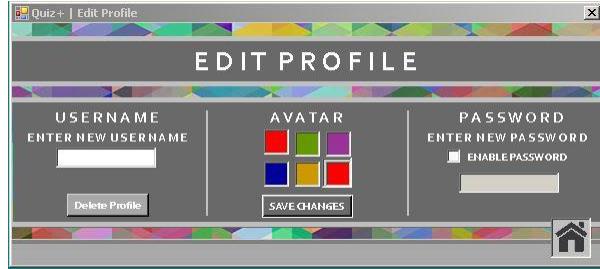
Test 16: Leave 'Edit Profile'



Test 16: Leave 'Player Statistics'



Test 17: Click 'Start Game'



Test 18: Click 'Edit Profile'



Test 19: Click 'Player Statistics'



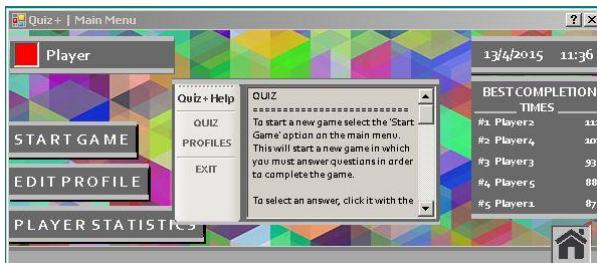
Test 20: Click home icon (1)



Test 20: Click home icon (2)



Test 21: Click help icon



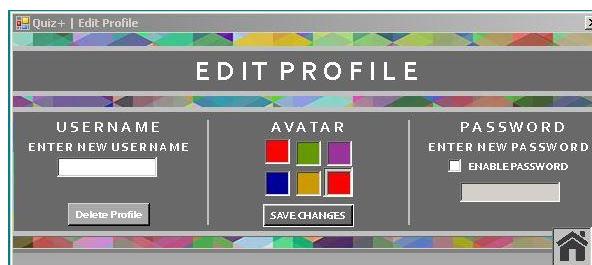
Test 22: Click 'Quiz'



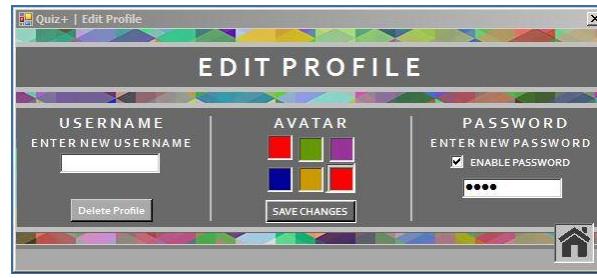
Test 23: Click 'Profiles'



Test 24: Click 'Exit'

EDIT_PROFILE

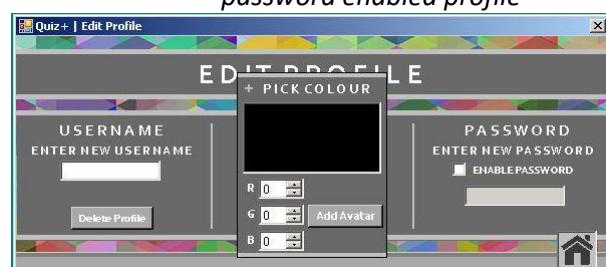
Test 25: Load 'Edit_Profile'



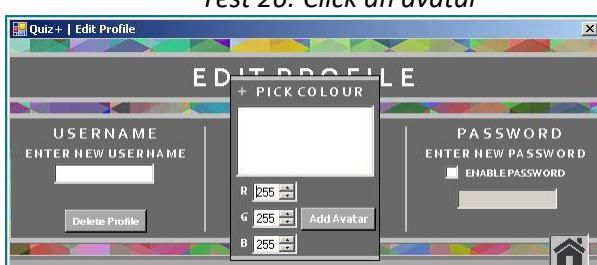
Test 25: Load 'Edit_Profile' with password enabled profile



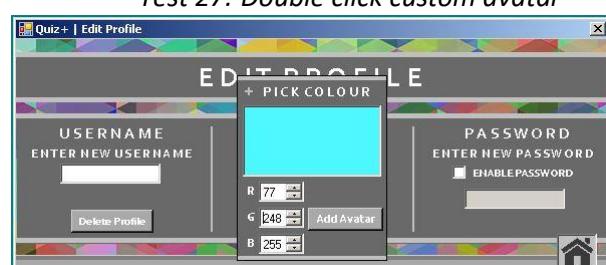
Test 26: Click an avatar



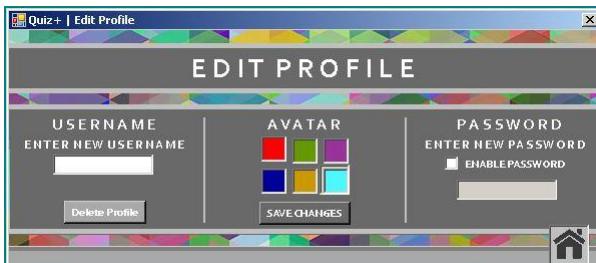
Test 27: Double click custom avatar



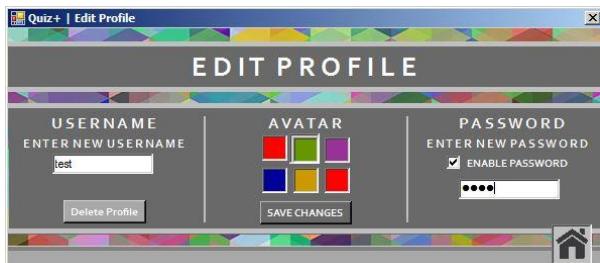
Test 28: Enter '256' in each numericUpDown control



Test 29: Use arrows on each numericUpDown



Test 30: Click 'Add Avatar'



Test 31: Changes made



Test 31: Click 'Save Changes'



Test 31: Changes worked



Test 31: No pass entered - Password worked



Test 32: Delete [1]



Test 32: Delete [2]



Test 32: Delete [3]



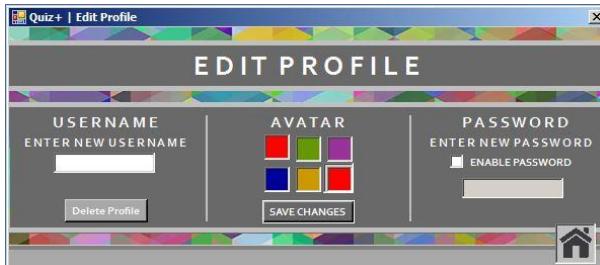
Test 32: Delete [4]



Test 33: Click 'Home' icon



Test 33: Click 'Yes'



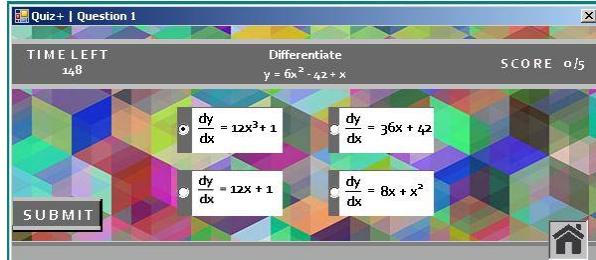
Test 33: Click 'No'

PLAYER_STATISTICS

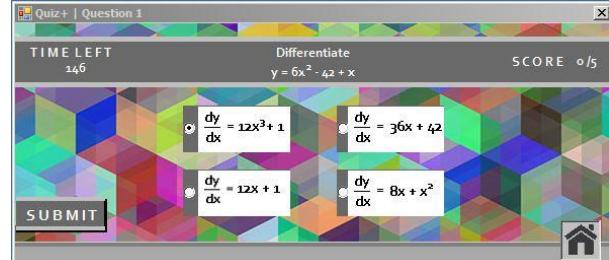
Test 34: Load 'Player_Statistics'



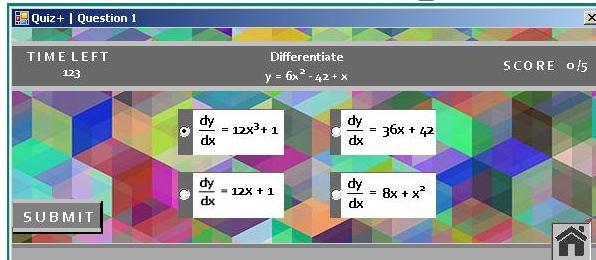
Test 35: Click home icon

QUESTION_1

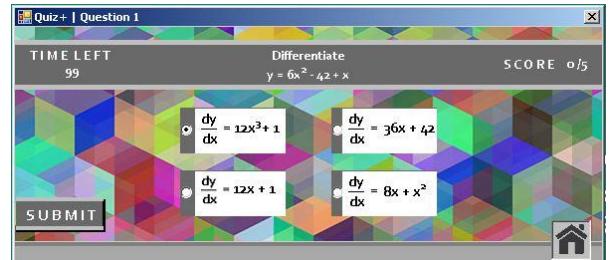
Test 36: Load 'Question_1'



Test 37: Timer



Test 38: Hover 'Submit'

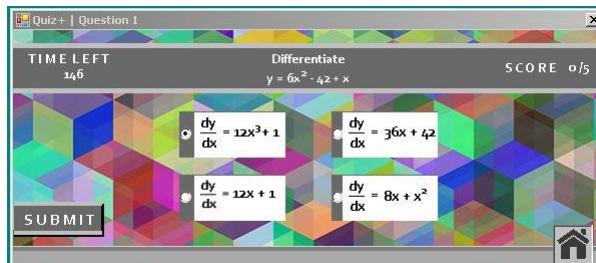


Test 39: Leave 'Submit'

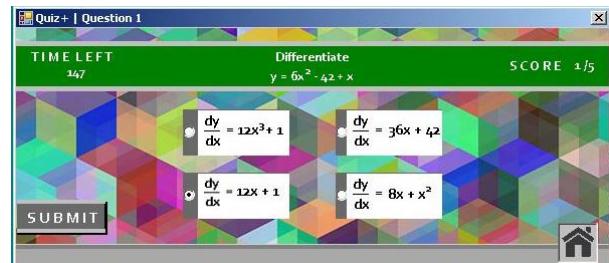


Test 40: Click home icon

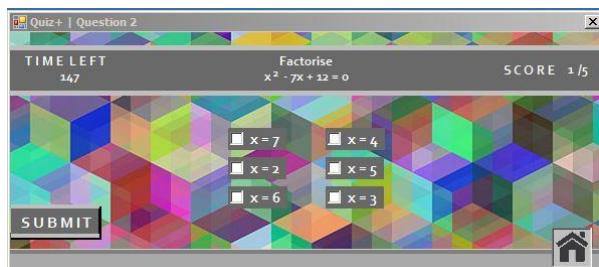
Test 40: Click 'Yes'



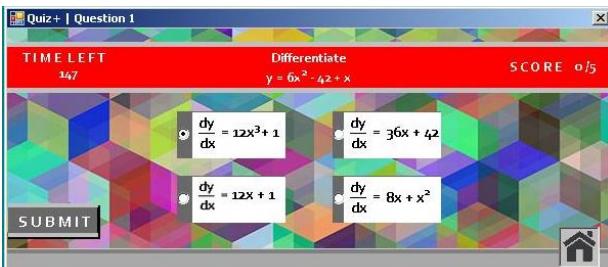
Test 40: Click 'No'



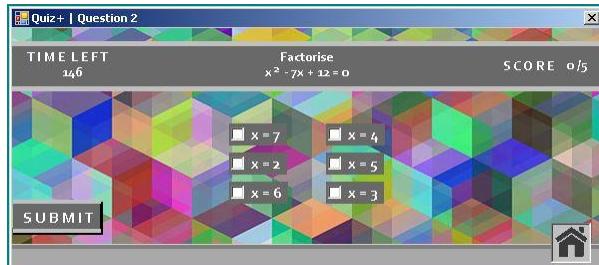
Test 41: Correct [1]



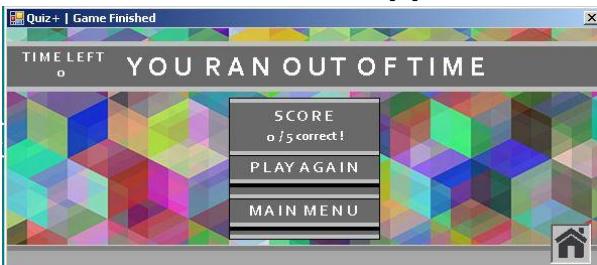
Test 41: Correct [2]



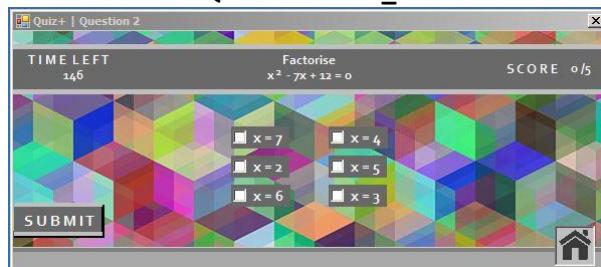
Test 42: Incorrect [1]



Test 42: Incorrect [2]



Test 43: Out of time

QUESTION_2

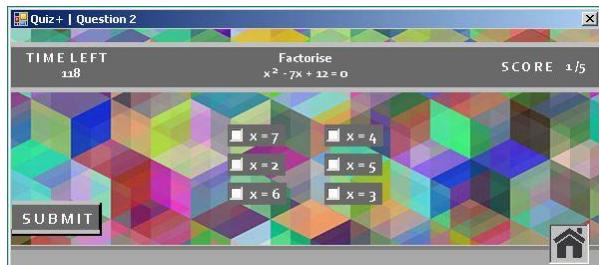
Test 44: Load 'Question_2'



Test 45: Timer



Test 46: Hover 'Submit'



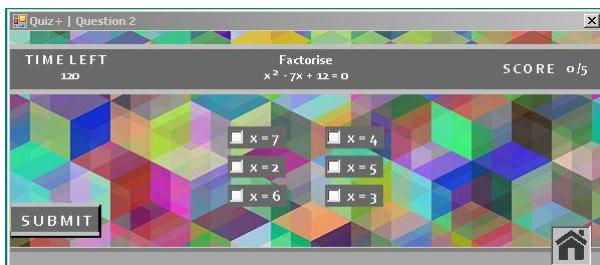
Test 47: Leave 'Submit'



Test 48: Click home icon



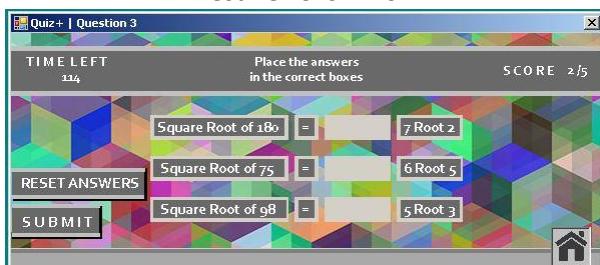
Test 48: Click 'Yes'



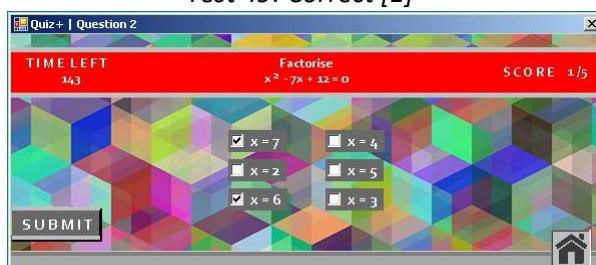
Test 48: Click 'No'



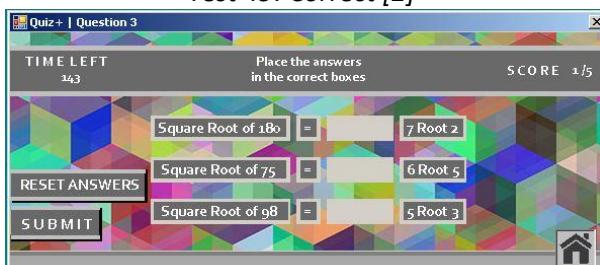
Test 49: Correct [1]



Test 49: Correct [2]



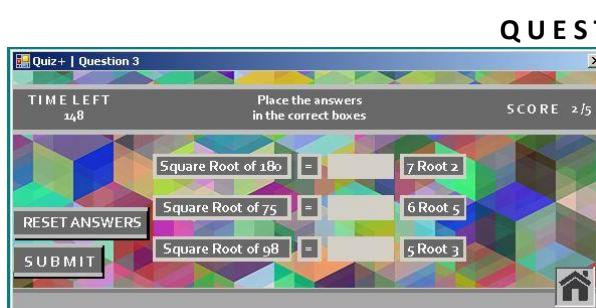
Test 50: Incorrect [1]



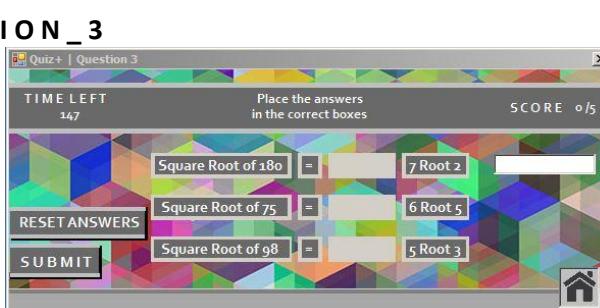
Test 50: Incorrect [2]



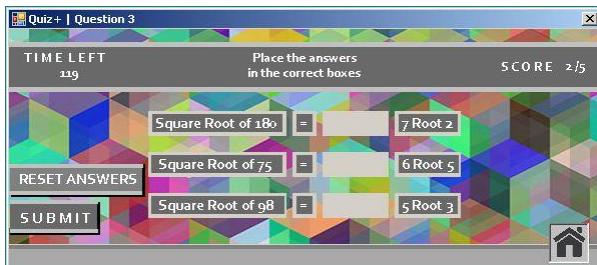
Test 51: You ran out of time



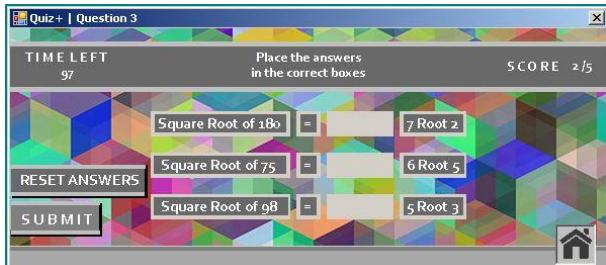
Test 52: Load 'Question_3'



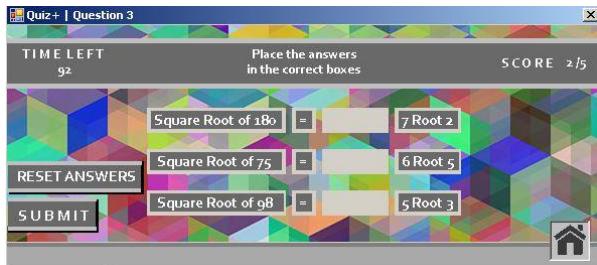
Test 53: Timer



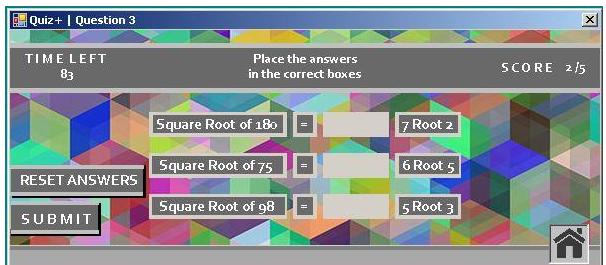
Test 54: Hover 'Reset Answers'



Test 54: Hover 'Submit'



Test 55: Leave 'Reset Answers'



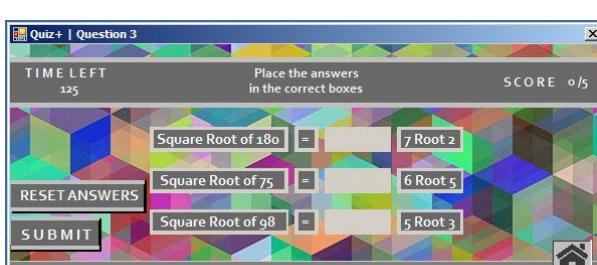
Test 55: Leave 'Submit'



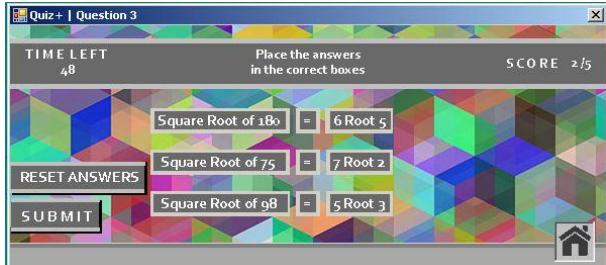
Test 56: Click home icon



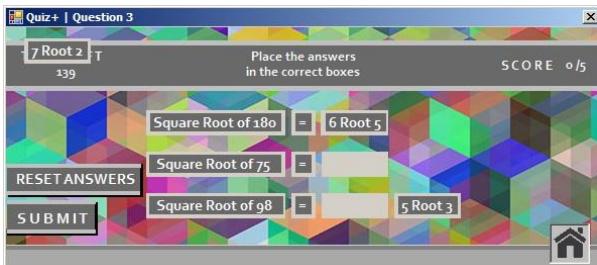
Test 56: Click 'Yes'



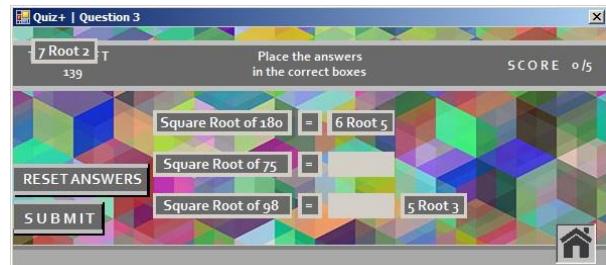
Test 56: Click 'No'



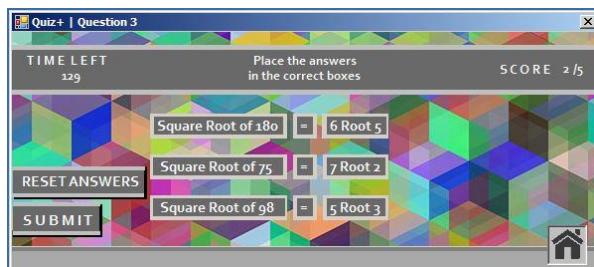
Test 57: Drag drop each answer into separate boxes



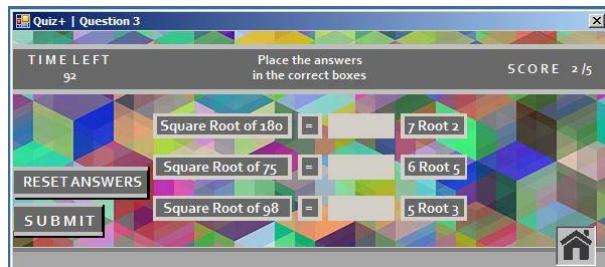
Test 58: Drag and drop an answer into an occupied box



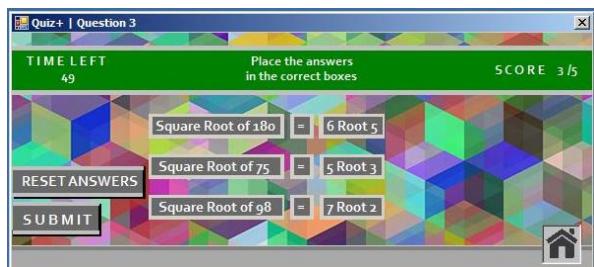
Test 59: Drag drop an answer into a random position



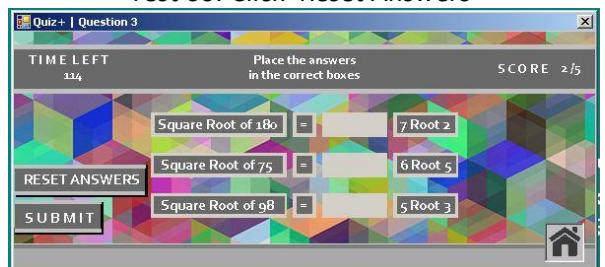
Test 60: Answers locked into boxes



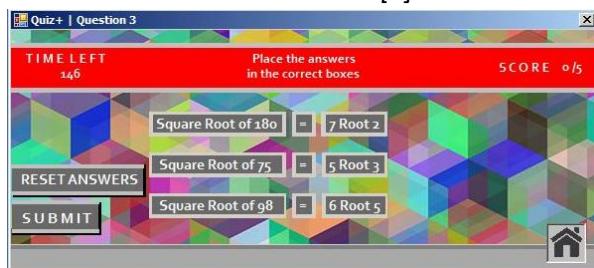
Test 60: Click 'Reset Answers'



Test 61: Correct [1]



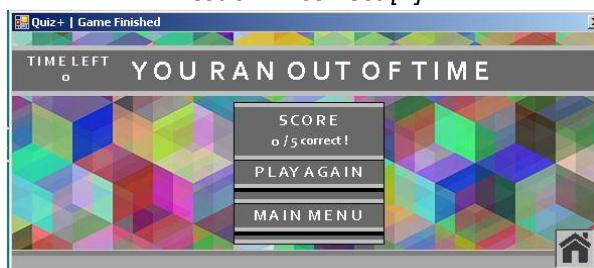
Test 61: Correct [2]



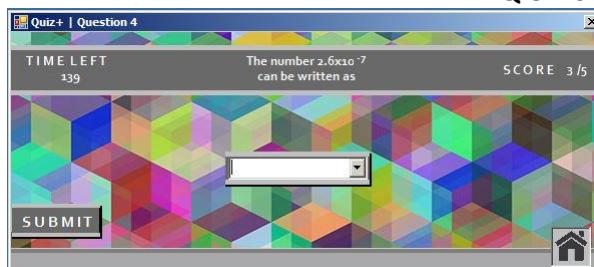
Test 62: Incorrect [1]



Test 62: Incorrect [2]



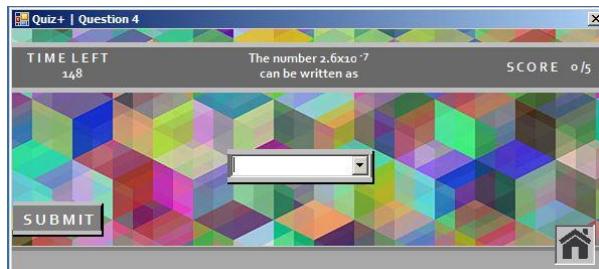
Test 63: Out of time

QUESTION_4

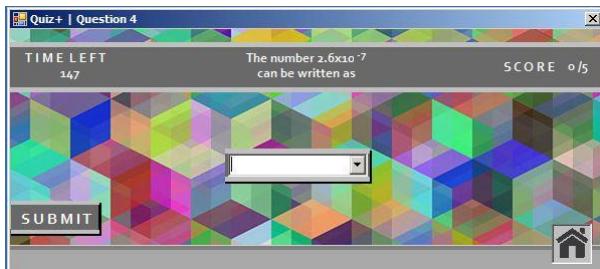
Test 64: Load 'Question_4'



Test 65: Timer



Test 66: Hover 'Submit'



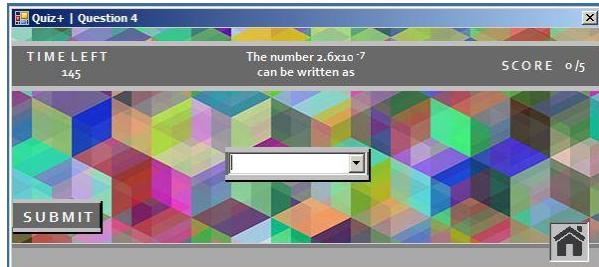
Test 67: Leave 'Submit'



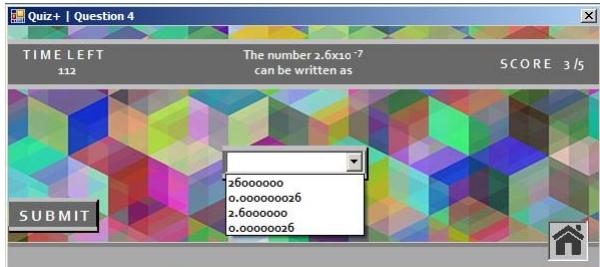
Test 68: Click home icon



Test 68: Click 'Yes'



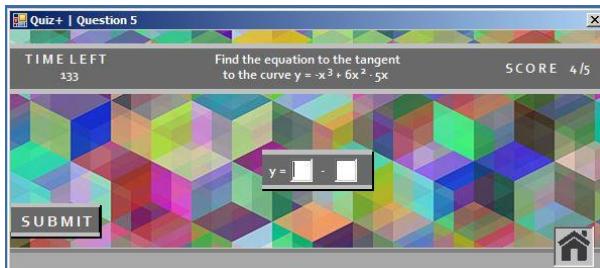
Test 68: Click 'No'



Test 69: Click comboBox arrow



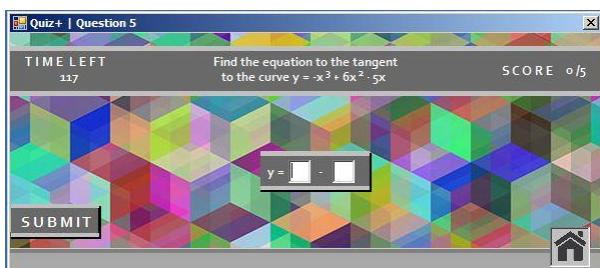
Test 70: Correct [1]



Test 70: Correct [2]



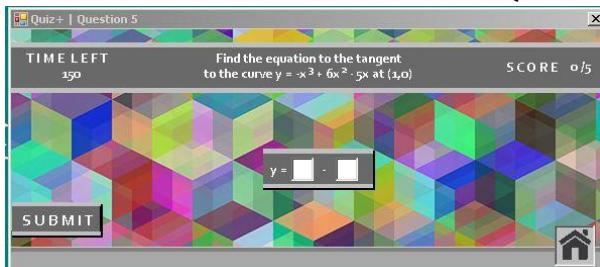
Test 71: Incorrect [1]



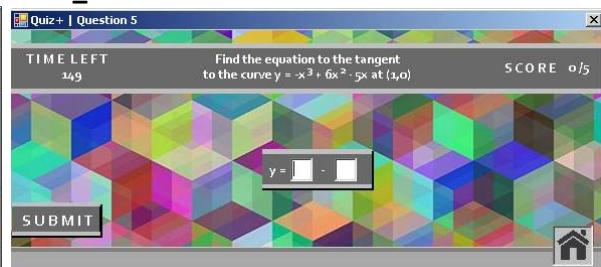
Test 71: Incorrect [2]



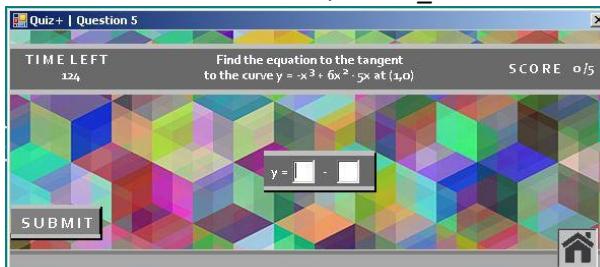
Test 72: Out of time

QUESTION_5

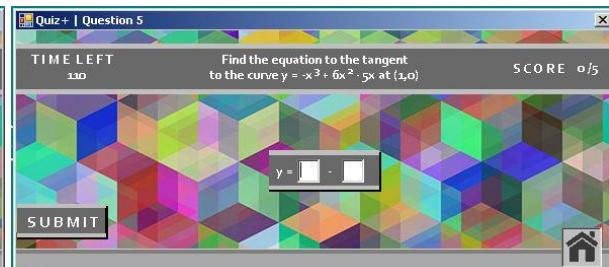
Test 73: Load 'Question_5'



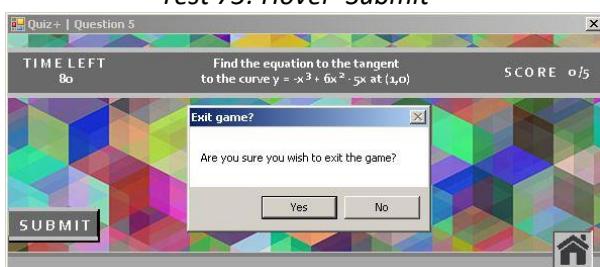
Test 74: Timer



Test 75: Hover 'Submit'



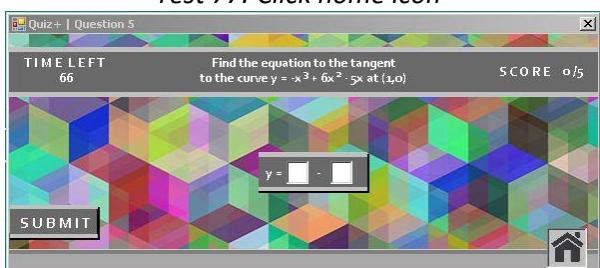
Test 76: Leave 'Submit'



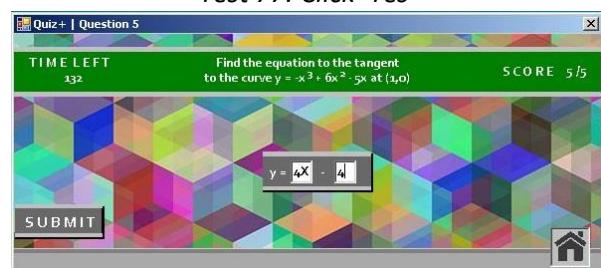
Test 77: Click home icon



Test 77: Click 'Yes'



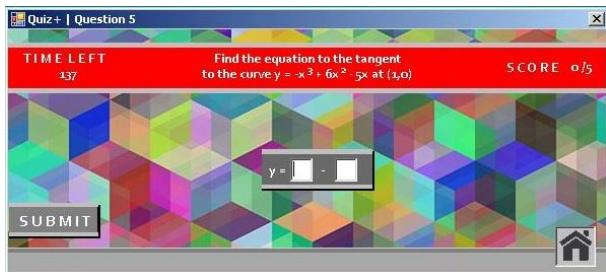
Test 77: Click 'No'



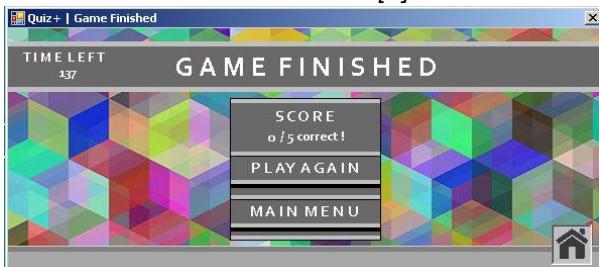
Test 78: Correct [1]



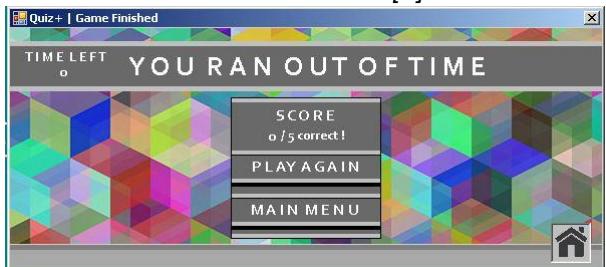
Test 78: Correct [2]



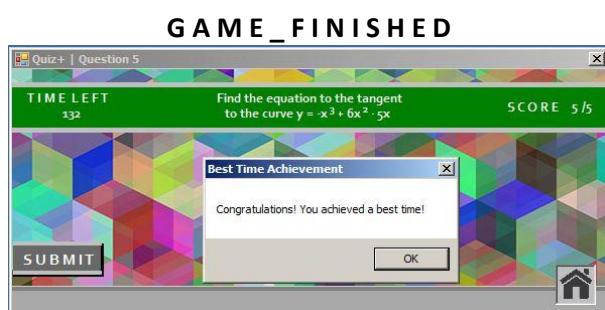
Test 79: Incorrect [1]



Test 79: Incorrect [2]



Test 80: Out of time



Test 81: Load 'Game_Finished' + player achieved a best time [1]



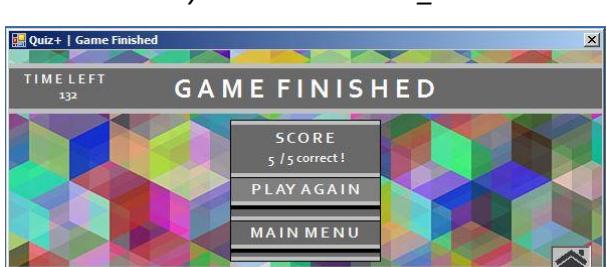
Test 81: Best Time [2] – Click 'OK'



Test 81: Best Time [3] – Best Time changed when you return to 'Main_Menu'



Test 81: Load 'Game_Finished' + player doesn't achieve a best time



Test 82: Hover 'Play Again'



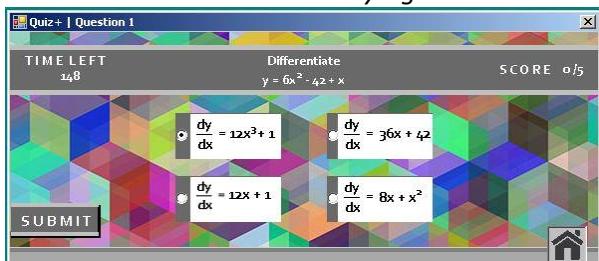
Test 82: Hover 'Main Menu'



Test 83: Leave 'Play Again'



Test 83: Leave 'Main Menu'



Test 84: Click 'Play Again'



Test 85: Click 'Main Menu'

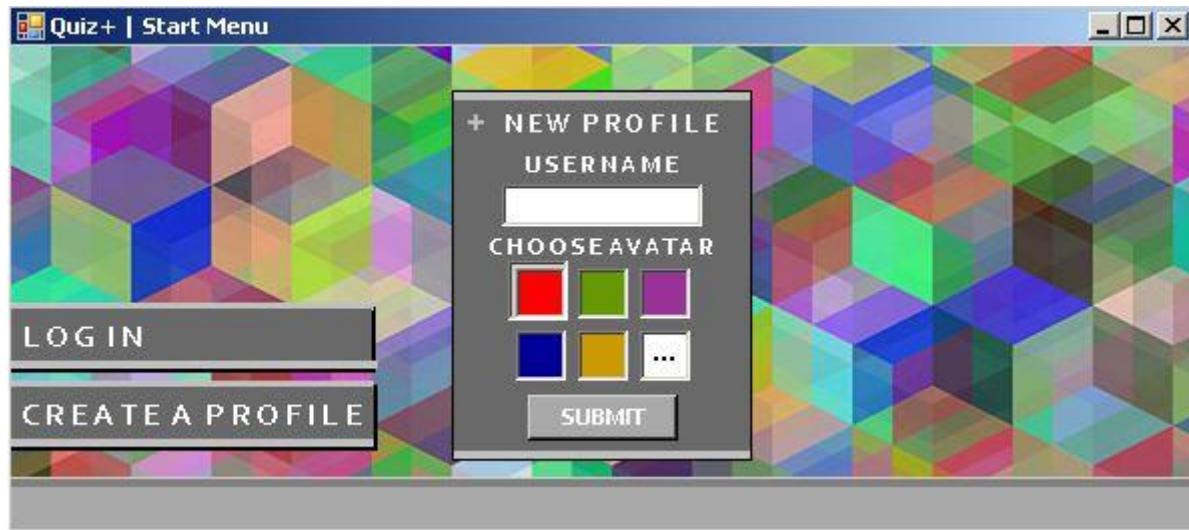
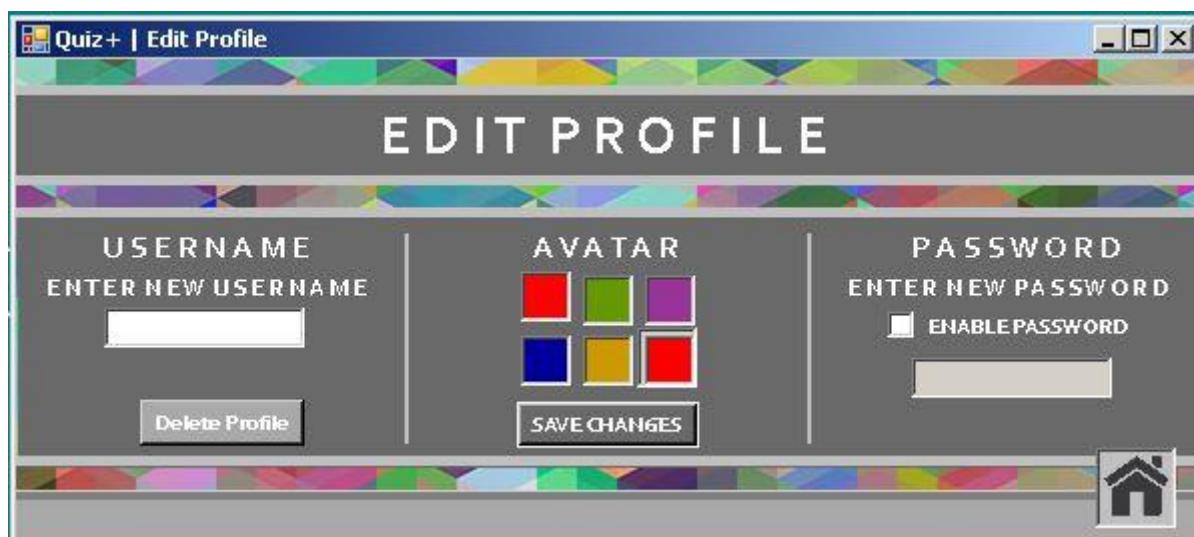
APPLICATION SCREENSENTHOTS



Start Menu – Welcome Message



Start Menu – Log In

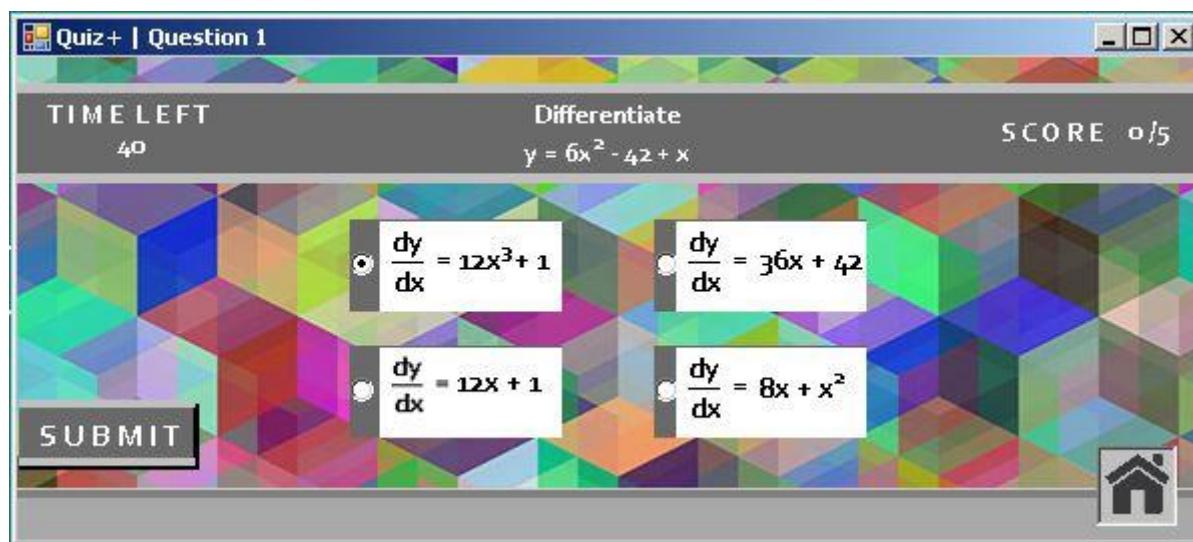
*Start Menu – Create A Profile**Main Menu**Edit Profile*



Edit Profile – RGB Colour Chooser



Player Statistics



Question 1

Quiz+ | Question 2

TIME LEFT
42

Factorise
 $x^2 - 7x + 12 = 0$

SCORE 0/5

x = 7 x = 4
 x = 2 x = 5
 x = 6 x = 3

SUBMIT

Home

Question 2

Quiz+ | Question 3

TIME LEFT
27

**Place the answers
in the correct boxes**

SCORE 0/5

RESET ANSWERS

SUBMIT

Home

Square Root of 180 = 7 Root 2

Square Root of 75 = 6 Root 5

Square Root of 98 = 5 Root 3

Question 3

Quiz+ | Question 4

TIME LEFT

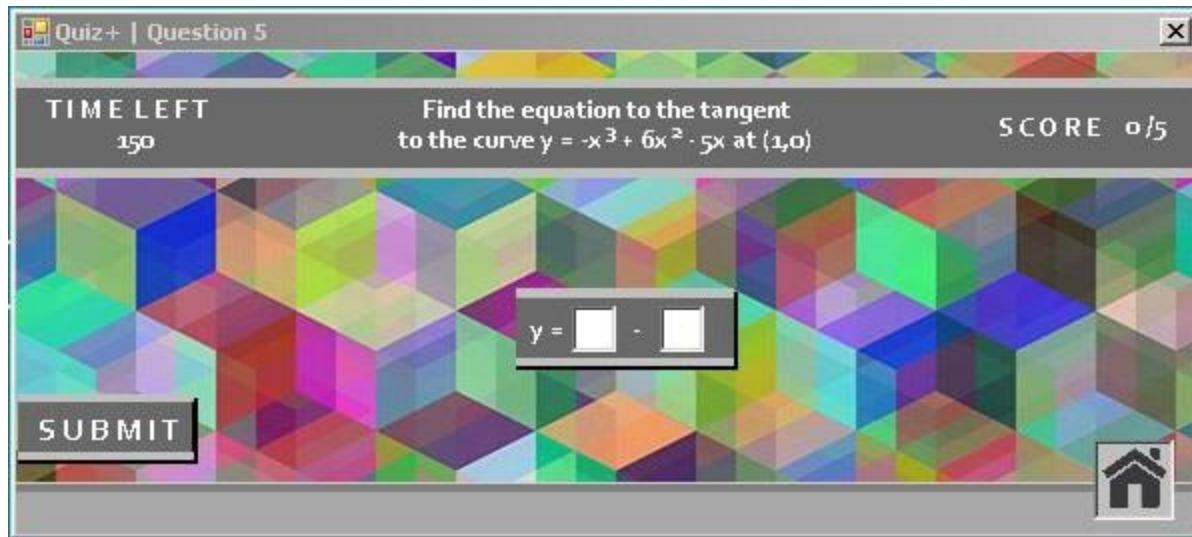
**The number 2.6×10^{-7}
can be written as**

SCORE 0/5

SUBMIT

Home

Question 4



Question 5



Game Finished

END USER QUESTIONNAIRE

PLEASE CIRCLE ONE FROM EACH OF THE FOLLOWING QUESTIONS
THEN WRITE ANSWERS IN THE TEXTBOXES PROVIDED

DID YOU FIND THE QUIZ USER FRIENDLY?

YES

NO

WOULD YOU CONSIDER THE DESIGN TO BE AESTHETICALLY PLEASING?

YES

NO

IN YOUR OPINION, WAS THE FEEDBACK GOOD?

YES

NO

**DO YOU BELIEVE THAT THE QUIZ WAS DIFFICULT ENOUGH TO BE CHALLENGING
BUT STILL ENJOYABLE TO PLAY?**

YES

NO

DID THE APPLICATION FULFILL YOUR EXPECTATIONS

YES

NO

WHAT DO YOU BELIEVE WERE THE STRENGTHS OF THE APPLICATION?

WHAT DO YOU BELIEVE WERE THE WEAKNESSES OF THE APPLICATION?

IF YOU COULD IMPROVE ANYTHING, WHAT WOULD IT BE?

EVALUATION

The task I was set out with was to develop a mathematics based quiz, tailored towards students undertaking the AS Mathematics course. In order to accomplish this, I first consulted the client to understand exactly the features and traits that they wished to have implemented into the application. They required that the application be **interactive**, **fun** and **challenging**. These 3 requirements made up the core principles utilised in the design and development of the application:

- In order to ensure that there is lots of user interaction, I implemented a variety of different styles of questions using a variety of controls for example a question which uses check boxes for answers, opening up a range of possible combinations to the user or another question in which I utilised textboxes which provide the user with the freedom to enter their own answer. The use of colour changes when the user hovers over a label such as those in the Main Menu creates a more complete experience for the user and aids in supplementing the development of the overall interactivity of the application.
- The combination of multiple styles of question sustains the user's attentiveness producing an enriching and exciting experience that continually stimulates the users mind through the effective use of an aesthetically pleasing interface and a well thought out overall design to the application
- In addition, to create a degree of challenge, I put into operation a timer so as to encourage the user to think fast and manage their time in a responsible manner. This helps the user to gain a good insight into the conditions and mind set needed to successfully fulfil their real exams and also assist in improving their time management skills. I also ensured that to employ varying levels of questions which in combination with the timer create a challenging experience requiring the user's full focus and attention in order to complete.

Through persistence and hard work I believe that I successfully developed an enriching and striking application that fulfils the qualities that I aimed to achieve. In particular, I believe that one of the major strengths is the aesthetic design of the quiz. During the development, I found myself dissatisfied with the original Design Plans and deciding to embark on bringing about major changes to the user interface. In particular, I ended up completely revamping both the Start Menu and Main Menu mid development which I believe paid off very well as the newly realised designs surpassed my original concept plans significantly assisting in not only creating a more striking application but also a more user friendly one, thus aiding me in working towards realising the core principle of interactivity originally outlined. As a result of the changes, I redesigned the Main Menu to a much simpler layout as I found with the original design, the screen seemed almost forcefully filled to take up whitespace which in turn wasn't very aesthetically pleasing. In the Start Menu I removed the avatar based login system and replaced it again text based login system, allowing for a much more streamlined design. The other major change I made was the introduction of a background to each form which I believe helped to breathe vibrancy and colour into the application, making it more appealing to the user to use. As a result of the extensive work devoted to improving the aesthetics, it ended up being praised by users as the best feature of the application, which tells me that it was worthwhile to focus so much time into refining the aesthetics as it I now know that it improved the overall experience for the user. Throughout, I also put particular focus in providing the user with feedback on any interactions they made with the application environment such as confirming the

user had saved changes when they exited the Edit Profile form and a message appearing telling the user that they achieved a best completion time. For me, the other major strength would be the profile system. In order to develop it, I researched various ways of storing data which led me to developing a text file based system which uses the StreamReader and StreamWriter functions to read in and write in files from and to the text files, in turn, vastly developing my software skills and introducing me into saving information, which significantly boosts the potential usability of future applications. In addition, I also introduced an RGB colour chooser for selecting avatars which is one of my favourite features of the application as instead of having the user to select a picture, they can instantly select any of 16,777,216 possible colours rather wasting time looking for an avatar that suits them. Although it took much trial and error to get the system to run successfully, the final profile system produced ended up running efficiently throughout the application and I was able to achieve all of the goals I originally set out for it including the implementation of a username, avatar, password and statistics surrounding the player's performance while playing the quiz.

However nothing can be perfect. In the case of the application, I would say that its weakest point is the actual content itself and through evaluation conducted by other users I found that the issue regarding the amount of content was also the most prominent issue that users had with the application as well. In order to save on time I decided to opt for a limited amount of questions which meant that the score achievable by the player was limited to '5'. Because of this I ended up creating a best completion time list rather than a high score list, however this may encourage user's to think carelessly in order to get the best time which is a quality that would prove detrimental if it was replicated in the real examination. I would say though the main underlying issue was that the coding itself was quite elongated and could definitely be reduced in some places to improve loading times and efficiency however part of this was due to allowing me to showcase an array of different coding techniques and practices but also due to the fact that I am only a beginner to programming.

Due to the issue regarding, if I were to improve anything it would be this. If possible, I would like to allow the user to select different categories related to mathematics topics so that users would be able to focus on the topics which they believe they need more experience in, improving their mathematical skills in the specific areas that require assistance. Within each topic, the introduction of a procedural question generator that formulates random questions would make the usability of the application endless and thus allow it to become a vital resource in learning maths. Another feature I believe would improve the application would be to integrate an online high score system that allows players to compare their high scores with those of anyone else who uses the application. This would not only make the application more fun for the user, but the idea of reaching the top score would give the user the incentive to work hard and so they would be improving their skills in a fun and challenging way. Personally one other improvement I would like to have is the ability to adjust the size of the application form and have it that the controls relocated and resize appropriately to retain proportions like a website, as it would help to make it easier to read the questions.

In the end, I am extremely happy with the end product produced. When I first began the development of the application, I set out with a limited amount of experience in programming in Visual C# and because of this I faced many technical challenges in attempting to fulfil my objectives such as the integration of a profile system, but by focusing and researching into new methods and techniques, I was able to develop my programming skills to a level that allowed me to accomplish the objectives set. The end result is that my skills and abilities not only in the development but the

documentation and testing of an application, seen vast growth and thus allowed me to not only achieve my core aims (interactivity, fun and challenge) but also those set out in the User Requirements. In particular, I also matured my skills in managing my time as this was the most crucial factor in deciding what would be implemented into the final application as it involved having to carefully delegate an appropriate amount of time for development, research and documentation so that each could be fulfilled to a reputable level. Ultimately, I believe that I have successfully produced an application that has reached the expectations set in many ways and enriched a vast range of my skills which will help me to excel in the future.