

Raleigh Charter High School Instructional Ideas for Active, Social, Creative Learning Opportunities  
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Sign Off

1. Put six to eight problems on a practice sheet. The problems should be of roughly the same difficulty.
2. Divide your students into the same number of groups as you have problems on the sheet.
3. Assign one problem to each group. When they complete this problem, they should bring it to you to check and “sign off” on. This group becomes the “sign off” experts for that particular problem, and all other groups should come to them to “sign off.” This allows you to help groups rather than just check work.
4. Once a group gets their first problem “signed off,” they should work the other problems on the practice sheet. As they complete them, these other problems should be taken to the “sign off” group for each particular problem.
5. Not every group has to finish every problem before you call time. You can end this activity once you believe that the students have gained an understanding of how to approach the problems.
6. Providing students with the answers to the problems that they didn’t complete gives them some additional problems to practice with outside of class.

Flyswatter

1. Write four or five important terms on the board that could be the answer to multiple questions. (For example: associative property, commutative property, distributive property, etc.)
2. Give a flyswatter to two different students and have them move to opposite sides of the terms in the front of the room.
3. Read a question and the first person to swat the term will have their flyswatter under the other person.
4. Read a question or two and then have two new people come up.
5. Begin the next question immediately, so they hurry to the board: (Downtime is the enemy of this game.)
6. Three rounds can be done in five minutes.
7. Terms can be changed to a new set of terms any time.
8. Another option for putting up questions is to create slides with the question at the top and the four or five answer choices lower on the slide. An LCD projector allows this to go very quickly
9. Teams can be made for small classes and you could write the terms twice and have four people play at a time depending on space in your room.

Checker Sheet

1. Create worksheets with problems grouped into sets of around four problems. Assign a color to each set.
2. Have students begin work on the problems.
3. As students finish a set, they must get those problems checked before moving on to the next set.
4. The teacher checks the answers to each set for the first few students done.
5. The first two students with correct answers to a set are each given a piece of colored paper to match the assigned color for the set.
6. These students then become the designated checkers for that set, and all other students must go to them, rather than to the teacher, to have their work checked.
7. When a student has checked a set for three different students, the checker can then pass the colored paper on to the next student that is checked. The new student becomes the designated checker for that set of problems.

Matching Cards

1. The teacher creates cards that can be matched in sets. These can be sets of two cards such as 9 and  $4+5$ , or they can be in larger sets like  $4+5$  and 9 and  $3*3$  and  $7/8$  and  $15-6$ . Make four or five sets of different cards (perhaps, create sets for 8, 10, 11, and 12 in addition to 9) and shuffle them together.
2. Put students in groups of about three and give each group a set of cards.
3. Instruct them to sort the problems out into the different sets.
4. The teacher can have varying levels of the sets, and when a group finishes one set, they can move on to a more challenging set. Not every group needs to get through every set for learning to be going on.

### Think, Share, Write

1. Students are quickly assigned partners.
2. The teacher puts a problem up on a slide or using the board. The teacher then says, "Think."
3. Students then THINK. They may read the problem and consider a strategy, but they are not allowed to speak or write.
4. After about 20 seconds, depending on the difficulty of the problem, the teacher says, "Share."
5. Students then SHARE with their partner. They may talk with their partner about their ideas on how to solve the problem, but they may not pick up their pencils yet.
6. After about 30 seconds, or when the conversations begin to die down or get off track, the teacher says, "Write."
7. All students then work the problem on their paper.
8. This is most effective on more difficult problems that students need to think through or on review problems that students need to recall from previous years.

### Group-Up Matching Cards

1. The teacher creates cards just like the ones used in Matching Cards, but with one card per student. The cards are then randomly distributed to students so that they each have one. (If there are leftover cards in order to create full sets, the teacher holds on to these.)
2. The teacher then tells students to find all the people that belong in their group. Depending on the age and ability level of the class, the teacher does not have to tell students how many belong in a group.
3. Students then talk with each other and share what is on their cards in order to match the complete set of cards.
4. The teacher will need to remind students if there are extra cards that might belong to their sets when there are leftovers.
5. After the sets are matched, each group must create one or two more facts that match the set that they have before they can turn in the set to the teacher.
6. This is an effective way to create random groups for another activity.

### 30-Seconds to Tell a Neighbor ... (Name or Decide or Choose or Finish)

1. Have students turn to a neighbor.
2. Give students a topic and ask them to spend 30 seconds discussing the topic. They can name three ways to do something or find the mistake in a previously worked problem or decide what possible use a topic could have in the real world.
3. Use this quickly and often when the lesson begins to lag or students are not responsive to a question the teacher asks.

### Guess Time: 5 to 10 min

1. Have 3 x 5 card with a word/person/equation for each student.
2. Give each student one card face down. NO LOOKING.
3. Have them hold up the card to their forehead facing outward so others can see the card.
4. Have them move around the room asking yes/no questions to attempt to determine what is on the card. When they guess the answer and a student tells them they are correct, they get to sit down.
5. They can only ask one question to any given student. This forces students to ask questions of lots of other students and to answer questions from many other students.
6. If students don't know if yes or no is the right answer, they should say so and (1) allow another question, (2) just say "I don't know," or (3) give the answer and say, "I am not sure."

Bluff Time: 5 min to 20 min

1. Divide the students into two teams
2. Have a list of questions.
3. Ask a question to team A and have anyone who thinks they know the answer raise their hand.
4. Ask one player on team B to choose one of the players on team A that has their hand up to answer the question.
5. If the person on team A that is chosen gets the answer correct then team A gets the number of points of the players who had their hands up. If wrong, NO points.
6. This encourages as many people to raise their hand as possible.

Pairs Graphing

1. Students work in pairs.
2. One student faces the front and can see the board or screen while the other student faces the back of the room and cannot see the information on the board or screen.
3. The teacher puts up a graph on the board or screen.
4. The student who can see the graph then describes it to his/her partner.
5. The student facing away from the problem then has to write the equation representing the graph using only the partner's description. The students may discuss the graph, but the student writing the equation may not turn around.
6. Students should switch places for the next round.
7. The teacher can circulate and help pairs determine what information is missing that would be helpful to complete the equation.

Jeopardy Time: 10 min to 30 min

1. Type the questions with the answers for each category.
2. Make one copy per group (suggested groups of 3 or 4 people)
3. One person is "game master" and reads the questions and keeps score.
4. A final jeopardy question is nice but optional.
5. Set a limit of ..... minutes and encourage them to get through as many questions as possible.
6. To see who buzzes in first a signal must be established. (I like one clap as hearing is easier to determine when reading than seeing)
7. If speed is involved, then I suggest subtracting points for misses.
8. Another way is to take turns and let one person choose a question and then answer with less worry about speed, then the next person picks a question. Each question can be equal value.
9. I also encourage them to finish a topic before moving on to another topic as it keeps the game moving and is less confusing.

Tic Tac Toe Time: 8 min to 25 min.

1. Teacher has a list of questions.
2. Students are quickly placed in pairs
3. Each pair has a piece of paper with a tic tac toe board
4. Student A in each group (randomly determined) gets the first question
5. They write the answer on the paper with the tic tac toe board.
6. If correct they make an X or O on the board; if incorrect they make no mark
7. Student B now gets a question to answer.
8. If correct they make a mark
9. First one to get tic tac toe wins. Start another game if more questions are coming.
10. Questions are read aloud to all the pairs, so everyone is playing at one time.
11. There should be no talking during the questions as the answers are written.
12. Time questions, so if they don't have answer in .... seconds they don't get to mark an answer. Easy questions (3 seconds), thoughtful questions (15 seconds)
13. Read answer aloud and say make the mark if correct and then immediately start the next question. 20 questions in 5 minutes is a reasonable expectation.

Soccer Time: 15 min to 25 min

1. Teacher types two lists of questions with answers in ( ) after the question.
2. Questions on a reading, study material, review, math, etc. can be used.
3. Divide students into pairs
4. Each student in the pair should get a different list of questions.
5. Each pair of students should be given either a piece of paper or small white board with a goal on each end and a field with 7 lines between the goals. The middle line should have a spot on it indicating where to start. A coin should be placed on the starting line in the middle.
6. Decide randomly who should start play.
7. The person opposite the person starting reads a question aloud to the starting player. If the question is answered correctly, then the coin is moved one line toward the goal AND the player gets another question. They continue to get questions until they miss or until the coin moves into the goal.
8. If the student misses, they do not move the coin forward, and the other player gets questions to answer until he or she misses.
9. When a goal is scored, it is recorded, and the coin moves to the middle of the field. The non-goal-scoring player gets a turn.

Red/ Black Time: 15 min to 25 min

1. Type a list of questions in the following format.
2. Make the first questions Red 2 then Red 3 and so on through Red Ace.
3. Make the second set of 13 questions Black 2 through Black Ace.
4. Type the answers for each of them on the back of the paper.
5. Make a copy for each group of three to five students.
6. Each group should have one person chosen as “game master”. He or she should be given the power of decision making for the game. He or she will read the questions and determine whether answers are sufficient and can call on you for help as needed.
7. Each group should get a ½ deck of cards that includes 13 clubs and 13 diamonds or 13 spades and 13 hearts.
8. After shuffling the cards, player A (randomly determined) draws a card.
9. The game master reads the question to player A and then gives a short amount of time for player A to answer. If they are correct, they keep the card. If they are incorrect, the correct answer is read.
10. The card that was missed is then placed back in the pile, and the cards are shuffled. The same question will come back, so it is important to listen for the correct answer when it is given after a miss.
11. Player B then draws a card and answers.
12. The person with the most cards when the teacher calls time will be the winner for each group.
13. A shorter game could have only 13 questions and not worry about the suits.
14. A longer game could include 52 questions using all four suits.
15. EMPHASIZE that they need to get through as many questions as possible. I often will circulate and run a game for a while then move to the next game and run it. I can usually get through about 10 questions a minute, which shows them it can be done. Longer, harder questions can be used, but I would suggest less of them.

JIGSAW Time: 10 to 20 min

1. Cut up an article or problem and let each student in a group of 3,4, or 5 read their section of the problem.
2. After a few minutes of reading and preparation, have them inform the other students about their section of the reading.
3. A game, quiz, or other checkup might be a good idea so they can see what they were supposed to share. This doesn't need to be graded to make the point.
4. A poem is a good idea for this, with each student getting a stanza or two.

SILENT DISCUSSION Time: 15 min to 45 min

1. This can be done as individuals or in groups of 2, 3, or 4.
2. Write down one essay/discussion question on the top of each large piece of paper.
3. I would suggest 5-7 different questions
4. Each person or group will always need a paper, so make copies as needed so each person or group starts with one.
5. Give each group 1-2 minutes to write the basic ideas of an answer.
6. Then pass the questions clockwise to the next group.
7. The next group will receive that question, read the question, read the response written by the first group, and then add to that answer (1-2 minutes).
8. Continue passing the questions around and add more comments, information, and ideas to each.
9. Other versions:
  - a. Have students write their name next to comments so you can collect them and see who wrote what.
  - b. Post the pages around the room and hall and let them move about adding where they think it is appropriate. (This allows for different depths and speeds of students)
  - c. Give them prompts after the first few rounds to add specifics.
  - d. After completing a full round, pass them around and let them read the answers.
  - e. Show overheads of good answers, so they can see what they essay was looking for, or point out ideas you had on subjects that would have been important and note whether they were able to come up with them as a group.

DISCUSSION QUIZ Time: 15 min

1. To determine if students understood a reading or homework assignment this works well.
2. Make a short 3, 5, or 10 question quiz on the assignment.
3. Have each student take out a piece of paper.
4. Give them 3 minutes to write down the five best statements they can make about the assigned reading.
5. At exactly 3 minutes have them make a line under their five statements and tell them they can NOT make any marks above the line or they will get a zero.
6. Give them 1 ½ minutes to talk to someone nearby to get two more statements. Have them write down those statements under the line.
7. At 1 ½ minutes say “stop” and have them write a line under those two statements.
8. Now as a group have them say some of their statements out loud and quickly write a few words or abbreviated versions on the board. As you list 6-10 on the board in five minutes, let them choose three to write down (WHILE YOU WRITE ON THE BOARD) under the second line.
9. At this point you have 9 ½ minutes invested.
10. ENCOURAGE them to share by giving good statements (A bonus of five points for a really good one) might help.
11. They now get five points for each statement they have written. This means 50 points for the ones who did the reading in most cases. The ones who didn’t might not be able to write the first five, but can probably still get the second 25 points.
12. Then give them the quiz you had made previously. It should be about a five minute quiz. This will be the final 50 points of the quiz. Let them use their 10 statements during the quiz as a “cheat sheet”, so those with good statements are rewarded.
13. I generally skim statements and rarely disqualify one. On rare occasions a student will write something that is obviously not on topic and that I don’t give credit. I don’t grade the statements for accuracy, as that would be tricky. The quiz will decide the grades, but if you have done the homework most students do pretty well. You may want to make a scale of 90= A- and 80 = B and so on if it is a hard topic.
14. I like this to help with readings, but it could be used after a lecture to see what students remember too.

PASSWORD Time: 5 min to 25 min

1. On 3 x 5 cards write one term or person that you want students to know
2. Have two teams
3. One player from each team comes to the front although you could have this in groups of 6 or 8 and run multiple games at once.
4. Both players look at the card.
5. Team A player gives one clue to his/her team and then calls on a person who thinks they know the answer.
6. IF correct then 10 points, and if incorrect Team B player gets a chance to give a clue.
7. If Team B gets it correct then they get 9 points.
8. If a person wants to have a sub replace himself/herself instead of giving a clue, this can be done as sometimes they have no idea what the word is.
9. Continue until someone gets the answer, or the answer is no longer worth any points.
10. Other versions:
  - a. Instead of doing one word for two teams, you can allow them to give clues until their team says the word. Then draw another word and give clues. Continue until your time is up and then the other team will take their turn for an equal time.
  - b. You can also write on the card certain words as a reminder to help them if needed.
  - c. You can also write words on the card that CANNOT be used in the description (like taboo)

PUTT PUTT OR BASKETBALL Time: 15 min to 25 min

1. Divide the group into four or five teams
2. Make a list of questions for the teacher.
3. Move desks and chairs to the side of the room OR Go outside.
4. Make four lines with masking tape on the floor.
5. If putt putt, bring a golf ball and a putter and place the lines about 1,2,3, and 4 meters from a soda can.
6. If basketball, I would bring a small ball (tennis balls are nice) and a garbage can. Place the lines a little farther away 2,4,5, and 7 meters from the garbage can.
7. Each team has one player that stands behind the line that is farthest from the garbage can or soda can.
8. Each player will have a white board (1 foot by 1 foot) or a clipboard with a piece of paper.
9. A question will be read and 10 seconds will be given for each person to answer.
10. The answer will be read and the players who answered correctly move up a line.
11. Those that are incorrect stay.
12. 4 questions are read. If a person gets all four correct they automatically get a point for their team. Otherwise the player will putt or shoot from the line they are on when they fourth questions is finished. If a person has missed all four questions, then they would have less chance of putting and hitting the soda can or making the basket. However, it can be done.
13. This game gives the student who is coordinated a chance to be successful if they can just get one or two questions correct.
14. After completing four questions, have a new player from each team go to the back line.
15. Questions can range from sophisticated to easy.

LECTURE BREAK Time: 3 min

1. Stop in the middle of a discussion or lecture.
2. Place students in pairs quickly (next to each other)
3. Have student A (randomly determined) tell student B one piece of information they remember.
4. Have student B then tell student A one piece of information.
5. Continue until one student can no longer give a piece of information. Sometimes a time limit of seven seconds could be used. After students give their statement, they slowly count down from seven to zero unless the other person can begin their statement.

### GROUP STORY TELLING Time: 5 min

1. To review a topic just studied or to discuss an issue, a ball is passed to a student in the room.
2. A starting statement is made by the teacher then the person makes the best statement they can think of to continue the story, series of events, or discussion.
3. They would then pass the ball to a new person who is not sitting next to them to continue the story.
4. A nice twist is to have the person to pass the ball to
  - a. The person most likely to go to the moon.
  - b. The most athletic person
  - c. The kindest person
  - d. The person who is most likely to write a crazy story for English.
  - e. Etc....
  - f. Every fifth statement could be reserved for the teacher to get back on topic.
5. Rules on how many times a person can speak are not a bad idea.
6. This activity could also be used in small groups. This could also be used to talk through a math problem being done by a student at the board.

### TOURNAMENT Time: 25 to 40 min

1. The teacher needs a list of questions and answers along with some tiebreaker questions that have a number for the answer.
2. Make an 8 team bracket for a tournament.
3. Divide the class into 8 teams. Teams can have 1, 2, 3, or even 4 players depending on how big the class is.
4. Team A plays Team B first. They each get a clipboard with paper or a white board section.
5. Read a question and let both teams write down the answer. Continue this for five questions.
6. The winning team advances. If there is a tie read a tiebreaker question, and the team that is closest goes on. Dates, Factoids, etc.. are good tiebreakers.
7. Continue this with four teams advancing to the second round, two to the third round and one grand winner.
8. I like to give a grade of C- to first round losers, B- to second round losers, and A- to semifinalist. However, I then give an assignment: Write a 100 word explanation of..... If they do the assignment, they then can still earn an A.
9. The key is to keep the game moving. Five questions can be done in 3 minutes, so the 7 contests could be done in the 25-35 min in most cases. In math, you might only have two questions per round and then a tie breaker.
10. I also suggest that the teacher either draws names randomly for teams ahead of time, or makes the groups based on ability to equalize them. You would not want to do this in class. Reading out students names and the letter of their team would only take 30 seconds and if the brackets are premade on the board or an overhead, they can see where they play.

### ROW RACE Time: 8 min to 15 min

1. The teacher needs a list of questions and answers.
2. Place students in rows. Give the first person in each row a blank piece of paper.
3. Ask a question and have each person with the paper write an answer.
4. If they are correct, they pass the paper back to the next person.
5. If they are incorrect, they keep it for the next question. I usually say if they miss three times, they can then pass it anyway. No sense in embarrassing someone.
6. Keep reading questions until one team's paper moves all the way to the back, or you can extend it by having the back person go twice and then have them pass it back to the front.

### MEMORY PRACTICE GAME Time: 3 to 10 min

1. Have students read a section, paper, list, or listen to a lecture, video etc....
2. In a group of 2 to 5, have them take turns making statements about what they remember from information.
3. Last one standing wins. Bring winners to front and play again from the beginning and say statements out loud to the whole class. This allows for students to practice and learn from others.

GROUP ANALYSIS Time: 10 min to 20 min.

1. Give each person in the group of 3, 4, or 5 a different color marker, colored pencil, crayon etc..
2. Give them a problem (best for math based unit) for each member of the group.
3. Allow them a small amount of time to begin the essay or problem.
4. Have them pass their problem to the next person and receive a different one.
5. Continue this until the problems are all completed.
6. Collect the papers with a color key to determine who did what.
7. It can be graded based on the number of correct points and mistakes.
8. Students should be finding mistakes as they go along as part of their time.

Children's Games (Chutes 'n' Ladders, Candy Land, Monopoly, etc.)

1. This activity can be done with any children's game. We purchase games at a discount dollar store. Usually, we use a variation of Snakes 'n' Ladders.
2. Math problems are placed on cards with one problem per card. The cards are stacked in the center of the game.
3. In groups of four, students play the board game using the normal game rules, but before they can take their turns, they draw a card from the stack of problems.
4. Students must work the problem on their card correctly, or they forfeit their turn.
5. This moves more quickly if all students draw individual cards at the same time. Each student who has correctly worked his/her particular problem takes a turn on that round.
6. Placing the solutions in a table with a designation indicating the row and column to look in for the answer makes it easier for the teacher to create the cards.
7. This does require the teacher to circulate. The students occasionally get so wrapped up in the game that they forget the math problems.

**Sample Problems for Children's Games** (These are normally cut into cards.)

A sector of a circle has central angle  $30^\circ$  and arc length 4. Find its area.

Solution B5

A sector of a circle has central angle  $60^\circ$  and arc length 5. Find its area.

Solution B6

Give an expression in terms of the integer  $n$  for the measure of all angles coterminal with  $-42^\circ$ .

Solution B7

Give an expression in terms of the integer  $n$  for the measure of all angles coterminal with  $57^\circ$ .

Solution B8

Find the value of the  $\tan \theta$  if the

$$\cos \theta = \frac{-5}{13} \text{ in Quadrant III.}$$

Solution B9

Find the value of the  $\cos \theta$  if the

$$\tan \theta = \frac{\sqrt{2}}{3} \text{ in Quadrant I.}$$

Solution B10

Find the value of the  $\cot \theta$  if the

$$\cos \theta = \frac{-\sqrt{2}}{2} \text{ in Quadrant II.}$$

Solution C1

Find the value of the  $\sec \theta$  if the

$$\tan \theta = \sqrt{3} \text{ in Quadrant III.}$$

Solution C2

Find the value of the  $\sin \theta$  if the

$$\cot \theta = \frac{-4}{3} \text{ in Quadrant IV.}$$

Solution C3

Find the value of the  $\cos \theta$  if the

$$\tan \theta = -1 \text{ in Quadrant II.}$$

Solution C4

Find all values for the angle  $\theta$

$$\text{where } 0 \leq \theta \leq 2\pi \text{ and } \cos \theta = \frac{-1}{2}.$$

Solution C5

Find all values for the angle  $\theta$

$$\text{where } 0 \leq \theta \leq 2\pi \text{ and } \sin \theta = \frac{-\sqrt{2}}{2}.$$

Solution C6

Find all values for the angle  $\theta$

$$\text{where } 0 \leq \theta \leq 2\pi \text{ and } \csc \theta = 2.$$

Solution C7

Find all values for the angle  $\theta$

$$\text{where } 0 \leq \theta \leq 2\pi \text{ and } \tan \theta = \frac{-\sqrt{3}}{3}.$$

Solution C8

**Sample Solutions for Children's Games**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<b>1</b>	$460^\circ, -260^\circ$	20	-1	$\frac{-1}{2}$	$-\cos\left(\frac{\pi}{4}\right)$	$\frac{13}{12}$
<b>2</b>	$\frac{7\pi}{6}$	$2\sqrt{10}$	-2	$\frac{\sqrt{2}}{2}$	$-\sin\left(\frac{\pi}{6}\right)$	$\frac{7}{24}$
<b>3</b>	$310^\circ, -410^\circ$	10	$\frac{-3}{5}$	$\sqrt{2}$	$-\sec\left(\frac{\pi}{6}\right)$	$\frac{5}{13}$
<b>4</b>	$\frac{-7\pi}{4}$	$4\sqrt{10}$	$\frac{-\sqrt{2}}{2}$	$\frac{\sqrt{3}}{3}$	$-\tan\left(\frac{\pi}{6}\right)$	$\frac{-\sqrt{2}}{4}$
<b>5</b>	$\frac{8\pi}{3}, \frac{-4\pi}{3}$	$\frac{24}{\pi}$	$\frac{2\pi}{3}, \frac{4\pi}{3}$	$\frac{-\sqrt{3}}{2}$	$\frac{\pi}{2} + 2\pi n$	$\frac{-\pi}{4}$
<b>6</b>	$240^\circ$	$\frac{75}{2\pi}$	$\frac{5\pi}{4}, \frac{7\pi}{4}$	$\frac{-\sqrt{3}}{3}$	$\frac{\pi}{2} + \pi n$	0
<b>7</b>	$\frac{13\pi}{4}, \frac{-3\pi}{4}$	$-42 + 2\pi n$	$\frac{\pi}{6}, \frac{5\pi}{6}$	$\frac{2\sqrt{3}}{3}$	$\pi + 2\pi n$	$\frac{\pi}{2}$
<b>8</b>	$-210^\circ$	$57 + 2\pi n$	$\frac{5\pi}{6}, \frac{11\pi}{6}$	$\frac{\sqrt{3}}{3}$	$\pi n$	$\frac{\pi}{6}$
<b>9</b>	$\frac{6}{\pi}$	$\frac{12}{5}$	$135^\circ, 315^\circ$	$-\cos(15^\circ)$	$\frac{-12}{5}$	$\frac{\pi}{4}$
<b>10</b>	5	$\frac{3\sqrt{11}}{11}$	$30^\circ, 330^\circ$	$\cot(50^\circ)$	$\frac{24}{7}$	$\frac{-\pi}{4}$
<b>11</b>	$\frac{6}{\pi}$	$\frac{13}{12}$	$150^\circ, 210^\circ$	$-\csc(70^\circ)$	$\frac{-12}{13}$	$\frac{5\pi}{6}$
<b>12</b>	25	$\frac{-\sqrt{22}}{11}$	$60^\circ, 240^\circ$	$-\tan(65^\circ)$	$\frac{2\sqrt{2}}{3}$	$\frac{\pi}{4}$