

Instructions

QAMT Rockhampton is delighted to make these questions available to you!

You should have received the following :

- * Instructions with Score Sheet
- * Individual Questions
- * Individual Questions Answers
- * Relay Questions
- * Relay Questions Answers
- * Team Questions
- * Team Questions Answers Sheet
- * Team Questions Answers
- * Shoot Out Questions
- * Student Participation Certificate
- * Teacher PD Certificate

AIMS

The students will:

- advance their interest in creative problem solving
- acquire problem solving skills and processes
- develop teamwork skills
- be highly involved in a session of intellectual fun in a scholarly atmosphere.

FORMAT

The competition consists of five events:

Individual Event	Each student has 3 minutes to individually complete a set of questions without a calculator. This focuses on using mental maths quickly.
Relay Event	Students work in pairs and rotate around as they solve questions. There are 25 questions to be answered in 30 minutes.
Team Event	Each team has 30 minutes to work together and answer 10 questions.
Estimation Event	During the Teams Event, students will be asked an estimation question. Each team has time to confer and furnish their best guess.
Shoot Out Event	Students will compete individually responding to questions read aloud until only one student from each year level remains. This focuses on listening carefully to the question being asked and using mental maths quickly.

**Queensland Association of Mathematics Teachers – Rockhampton Branch
Maths Teams Challenge 2020**

TEAMS

A team consists of 5 students in the appropriate year levels. This can be a team where all 5 students are the same year level or mixed teams of different year levels.

MATERIALS

Each student **MUST** bring:

- a calculator of any type
- pens, pencils, eraser, ruler

SUPERVISORS

One adult or senior student **MUST** accompany **EACH** team. They will assist as a Supervisor in all events. This need not be a teacher nor needs any mathematical knowledge but must be Year 10 or older and needs to be able to follow simple instructions given to them. If a team does not have a supervisor, it will be difficult for them to participate.

STUDENT PARTICIPATION CERTIFICATE

Print one per student.

TEACHER PD CERTIFICATE

Print one per teacher involved in organising, hosting, or supervising the challenge.

Every effort has been made to ensure the questions and answers are correct. Adjust as necessary should you find an error.

Individual Event

HOST MATERIALS

* Individual Questions

- Five pages, single sided page of 20 questions per student.
- Each student should have different questions.
- *Copy one set of five per team.*

* Individual Questions Answers

- One page, double sided.
- *Copy one per team supervisor. These should not be shown to students.*

STUDENT MATERIALS

- * Students should have a pencil or pen.
- * No calculators allowed.

PROCEDURE

- Students have 3 minutes to answer as many questions as possible.
 - Students work individually. They should not consult or help each other.
 - Units are not required.
 - Give each student one page face down.
 - As the timer is started, students flip over the page and begin work.
 - Students stop work after 3 minutes.
 - Supervisor collects the five sheets from the team.
- Keep them together. Individual sheets do not have space for identification.

- Supervisor should write the Year, School, and Team Number on the Individual Questions Answers sheet.
- Supervisor marks each sheet submitted by students.

SCORING

- * Each question is worth one mark. Award full marks even if units are not included.
- * Each student can earn a maximum of 20 marks.
- * The team can collectively earn a maximum of 100 marks for this event.

Relay Event

HOST MATERIALS

- * Relay Questions
 - 25 pages, one question per single sided page
 - *Copy one set per team, single sided and stapled.*
- * Relay Questions Answers
 - One page, single sided.
 - *Copy one per team supervisor. These should not be show to students.*

STUDENT MATERIALS

- * Students should have a pencil or pen.
- * Calculators are allowed.
- * Spare scribble paper may be used, although each question page should have enough space for working out.

PROCEDURE

- Students have 30 minutes to complete as many questions as possible.
- Students work in pairs with a pivot on the end and rotate, as per the instructions on the next page.
- Units are required when applicable.
- Supervisor should write the Year, School, and Team Number on the Relay Questions Answers sheet.
- Supervisor keeps score, as per the instructions on the next page.
- Question is incorrect if units are not included.

SCORING

- * Each question is worth a maximum of 8 points.
- * The team can collectively earn a maximum of 200 points for this event.

Supervisor's Instructions - RELAY Event

Equipment

1 set of Relay Questions – questions 1 to 25 arranged in the correct order

1 Relay Answer / Score Sheet (*Please ensure that this sheet CANNOT be seen by students AT ANY TIME*)

Identification of Teams

On the Answer Sheet:

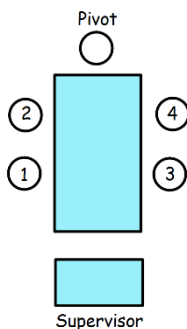
CIRCLE the appropriate YEAR LEVEL

WRITE the SCHOOL NAME and TEAM NUMBER

Procedure

Team splits into two pairs and a "Pivot".

One pair should be seated on the left side of the table (positions 1 and 2) and one pair should be seated on the right side of the table (positions 3 and 4). The fifth student should be standing at the end of the table in the "Pivot" position.



- ⇒ The supervisor hands Q1 to players in Positions 1 & 2, and Q2 to players in Positions 3 & 4. The players in each pair work collaboratively. Input from the other pair or the Pivot is **NOT** permitted.
- ⇒ Players write their answers on the question sheet and hand it to the supervisor for marking. The marker records the answer as correct or incorrect in the appropriate column on the Relay Event Score Sheet.
- ⇒ Each time the pair of players in Positions 1 & 2 completes a question by getting it correct, or has 3 incorrect answers, or passes, the player in the Pivot Position moves to Position 2 and that player moves to Position 1. The player in Position 1 moves to the Pivot Position.
- ⇒ Similarly, each time the pair of players in Positions 3 & 4 complete a question by getting it correct, or has 3 incorrect answers, or passes, the player in the Pivot Position moves to Position 4 and that player moves to Position 3. The player in Position 3 moves to the Pivot Position.
- ⇒ Each time a question is answered correctly, or has been answered incorrectly 3 times, or has been passed by a pair, and the players have rotated, the supervisor hands the next question to the new pair.

This process continues until either (a) time has run out or (b) all questions have been attempted.

When the instruction to BEGIN is given, the pair of students on the left is given Question 1 and the pair of students on the right is given Question 2.

The Pivot cannot give any assistance to either pair working on a question, and the pairs cannot assist each other or exchange questions.

PASSED QUESTIONS MAY NOT BE ATTEMPTED LATER.

Time Allowed

The relay event will run for about 45 minutes. Students have approximately 30 or 40 minutes to complete as many of the 25 questions available.

If the team has answered all questions before time has expired, the event continues for all other teams. That is, the event is not simply a 'race'. Encourage students to further review the questions, but they cannot score any more points.

Scoring

For each Relay question circle the score box on the ANSWER SHEET as follows:

If the answer provided on the FIRST attempt is CORRECT
8 points

If the answer provided on the SECOND attempt is CORRECT
6 points

If the answer provided on the THIRD attempt is CORRECT
4 points

If the answer provided on the THIRD attempt is INCORRECT
OR
If the team chooses to PASS on a question at any time
0 points

When an answer is presented for marking, you may only state CORRECT or INCORRECT and the number of the attempt. No hints or guidance may be given to the students, even if it is a second or third attempt.

When time is called, if a team has already passed an answer to you, it will be accepted and marked as usual.

You and the team captain will total the number of points for that team and record that result on the bottom of the score sheet.

The score sheet will be collected from you.

Disputes / Confusion

If at any time during the event you have a procedural concern, or you are unsure whether an answer you have received is correct or not, raise your hand to request assistance. A judge will assist you immediately.

Estimation Event

* Runs concurrently with the Team event.

HOST MATERIALS

* *Host school will need to find something students can estimate which has a known answer.*

Some ideas are included, but anything similar that host schools have would be fantastic too.

- Fill a jar with lollies/jelly beans/skittles/m&m's/etc.

Students estimate the number of lollies inside the jar.

- Fill a translucent box with marbles or dice.

Students estimate the number of items inside the box.

- Fill a jar with coloured sand.

Students estimate the percentage or proportion of sand in the jar which is a particular colour.

- Print a picture of a pepperoni pizza with lots of pepperoni on it.

Students estimate how many slices of pepperoni are on the pizza by looking at the picture.

- Fill a container with liquid.

Students estimate the number of millilitres of liquid in the jar.

STUDENT MATERIALS

* see the Team Event

PROCEDURES

- As students are working on the Team Questions, bring this around to each team.

- Give them time to view the item and agree on an answer.

-- Each team writes their agreed answer in the Estimation Event Response blank at the bottom of the Team Questions Answer Sheet.

The time each team has to form their guess should be short enough to encourage estimation rather than actually counting and so that every team will have a chance to do so before the Team Event finishes. This can change dependent on the number of teams present and the nature of the estimation being done.

SCORING

* The team with the closest guess to the known answer is declared the winner.

* No points are awarded for this event. It may be used as an overall tie breaker later or just something fun to do. If host schools do not have something for this event, then leave this part of the Team Questions Answer Sheet blank.

Team Event

HOST MATERIALS

- * Team Questions
 - One page, double sided. 10 questions.
 - *Copy one per student.*
- * Team Questions Answers Sheet
 - One page, single sided.
 - *Copy one per team.*
- * Team Questions Answers
 - One page, single sided.
 - *Copy one per supervisor. These should not be shown to students.*

STUDENT MATERIALS

- Students should have a pencil or pen.
- Calculators are allowed.
- Spare scribble paper. The Team Questions sheet does not have room for working out.

PROCEDURE

- Students have 30 minutes to complete as many questions as possible.
- Students work as a team. They may consult with each other.
- Units are required when applicable.
- Give each student a copy of the Team Questions.
- Give each team a copy of the Team Questions Answers Sheet
- Students should write the Year, School, and Team Number on the Team Questions Answers Sheet.
- Before time is up, the team must have written their final agreed answer to each question on the Team Questions Answers Sheet.
- At the end of 30 minutes, the supervisor collects the Team Questions Answers Sheet.
- Mark according to the answers provided. Question is incorrect if no units are included.

SCORING

- Points vary per question. Award points as noted.
- The team can collectively earn a maximum of 200 points for this event.

Supervisors may attempt the questions from a separate copy of the Team Questions. *Make additional copies of the Team Questions and Team Questions Answer Sheet as necessary.*

Shoot Out Event

HOST MATERIALS

- * An emcee to read the questions aloud.
- * Shoot Out Questions
 - *Copy one set for the emcee.*

STUDENT MATERIALS

- * Scribble paper and large or dark pens.
- or
- * A mini whiteboard with a whiteboard marker

PROCEDURE

- Students work individually. They should not consult with each other. They should cover their responses until directed.
- Host reads the first question aloud clearly to students twice.
- Repeating the question more than twice is not allowed.
- Students listen to the question being asked.
- Students have no more than 10 seconds to answer the question.
- Students write their answer large and legible on a piece of scribble paper or mini whiteboard. This must be large enough for the supervisor to see.
- Units are not required.
- When directed by the host, students hold up their answer for the supervisor to see.
- Host reads out the correct answer.
- Supervisor adjudicate student responses.
- Students with correct answers continue on with the next question.
- Students with incorrect answers are eliminated.
- Host reads aloud the next question clearly twice.
- Continue with this until there is only one student left.

SCORING

- The last remaining student is declared the Shoot-Out Winner.
- No points are awarded for this event. QAMT uses it an event to engage the students as the final scores are being tallied by other facilitators in the room for the results presentation at the conclusion of the competition.

**Queensland Association of Mathematics Teachers – Rockhampton Branch
Maths Teams Challenge 2020**

Maths Teams Challenge Score Sheet

Team Number	Individual (out of 100)	Relay (out of 200)	Team (out of 200)	Total (out of 500)

Final Results

Place	Team Number
First	
Second	
Third	

Queensland Association of Mathematics Teachers – Rockhampton Branch
Maths Teams Challenge 2020 – Year 11 & 12 Individual Questions

Student 1

Instructions : Calculators are not allowed. Write the answer to each question on the line provided.

_____ 1) $4 \times 5 + 10 \div 2$

_____ 2) $3^2 + 2^2$

_____ 3) Factorise $24x^2 + 8x$ completely.

_____ 4) How many quarters are in $2\frac{1}{4}$?

_____ 5) Simplify $\frac{9}{14} + \frac{3}{7}$ into an improper fraction.

_____ 6) Increase \$600 by 15%.

_____ 7) Solve $\frac{2x+1}{3} = 5$ for the pronumeral.

_____ 8) Expand $(k+5)^2$.

_____ 9) Calculate the mean of the values : 7, 9, 14.

_____ 10) $\left(\frac{\cot^2 \theta + \csc^2 \theta}{\sec^2 \theta}\right)^0$

_____ 11) Simplify $\log_2 8$.

_____ 12) A square has area 144 cm^2 . Find its side length.

_____ 13) Give the equation of a line with slope 4 and y -intercept $(0, 8)$ in slope-intercept form.

_____ 14) Simplify $(2x^2 - 5x + 4) + (3x^2 + 7x + 5)$.

_____ 15) On the graph of $y = 2x^2 + 17$, identify the y -intercept.

_____ 16) Solve $3^x = 81$ for x .

_____ 17) How many metres per hour are equivalent to 3.8 km/h?

_____ 18) Simplify $\left(\frac{36}{49}\right)^{\frac{1}{2}}$.

_____ 19) What is the radius of a circle with circumference 16π ?

_____ 20) If $x = -3$ and $y = 2$, evaluate $x^2 - 5x + 2y$.

Queensland Association of Mathematics Teachers – Rockhampton Branch
Maths Teams Challenge 2020 – Year 11 & 12 Individual Questions

Student 2

Instructions : Calculators are not allowed. Write the answer to each question on the line provided.

_____ 1) $5 \times 6 + 15 \div 3$

_____ 2) $2^2 + 5^2$

_____ 3) Factorise $18x^2 + 6x$ completely.

_____ 4) How many quarters are in $1\frac{3}{4}$?

_____ 5) Simplify $\frac{11}{18} + \frac{4}{9}$ into an improper fraction.

_____ 6) Increase \$300 by 15%.

_____ 7) Solve $\frac{5x + 2}{4} = 3$ for the pronumeral.

_____ 8) Expand $(d + 4)^2$.

_____ 9) Calculate the mean of the values : 7, 6, 11.

_____ 10) $\left(\frac{\sec^2 \theta + \cot^2 \theta}{\csc^2 \theta}\right)^0$

_____ 11) Simplify $\log_2 16$.

_____ 12) A square has area 81 cm^2 . Find its side length.

_____ 13) Give the equation of a line with slope 2 and y -intercept $(0, 3)$ in slope-intercept form.

_____ 14) Simplify $(5x^2 - 3x + 2) + (4x^2 + 9x + 3)$.

_____ 15) On the graph of $y = 3x^2 + 14$, identify the y -intercept.

_____ 16) Solve $4^x = 64$ for x .

_____ 17) How many metres per hour are equivalent to 4.6 km/h?

_____ 18) Simplify $\left(\frac{49}{64}\right)^{\frac{1}{2}}$.

_____ 19) What is the radius of a circle with circumference 10π ?

_____ 20) If $x = -2$ and $y = 4$, evaluate $x^2 - 4x + 3y$.

Queensland Association of Mathematics Teachers – Rockhampton Branch
Maths Teams Challenge 2020 – Year 11 & 12 Individual Questions

Student 3

Instructions : Calculators are not allowed. Write the answer to each question on the line provided.

_____ 1) $3 \times 4 + 12 \div 6$

_____ 2) $2^2 + 4^2$

_____ 3) Factorise $15x^2 + 5x$ completely.

_____ 4) How many quarters are in $1\frac{1}{2}$?

_____ 5) Simplify $\frac{7}{10} + \frac{2}{5}$ into an improper fraction.

_____ 6) Increase \$200 by 15%.

_____ 7) Solve $\frac{4x + 2}{3} = 6$ for the pronumeral.

_____ 8) Expand $(z + 3)^2$.

_____ 9) Calculate the mean of the values : 9, 8, 16.

_____ 10) $\left(\frac{\sin^2 \theta + \tan^2 \theta}{\cos^2 \theta}\right)^0$

_____ 11) Simplify $\log_3 27$.

_____ 12) A square has area 64 cm^2 . Find its side length.

_____ 13) Give the equation of a line with slope 6 and y -intercept $(0, 9)$ in slope-intercept form.

_____ 14) Simplify $(4x^2 - 2x + 1) + (3x^2 + 5x + 3)$.

_____ 15) On the graph of $y = 5x^2 + 12$, identify the y -intercept.

_____ 16) Solve $2^x = 16$ for x .

_____ 17) How many metres per hour are equivalent to 5.7 km/h?

_____ 18) Simplify $\left(\frac{64}{81}\right)^{\frac{1}{2}}$.

_____ 19) What is the radius of a circle with circumference 14π ?

_____ 20) If $x = -4$ and $y = 2$, evaluate $x^2 - 2x + 5y$.

Queensland Association of Mathematics Teachers – Rockhampton Branch
Maths Teams Challenge 2020 – Year 11 & 12 Individual Questions

Student 4

Instructions : Calculators are not allowed. Write the answer to each question on the line provided.

_____ 1) $6 \times 7 + 14 \div 2$

_____ 2) $7^2 + 2^2$

_____ 3) Factorise $21x^2 + 7x$ completely.

_____ 4) How many quarters are in $1\frac{1}{4}$?

_____ 5) Simplify $\frac{5}{6} + \frac{7}{12}$ into an improper fraction.

_____ 6) Increase \$400 by 15%.

_____ 7) Solve $\frac{3x+1}{2} = 5$ for the pronumeral.

_____ 8) Expand $(y+2)^2$.

_____ 9) Calculate the mean of the values : 8, 6, 13.

_____ 10) $\left(\frac{\cos^2 \theta + \tan^2 \theta}{\sin^2 \theta}\right)^0$

_____ 11) Simplify $\log_4 16$.

_____ 12) A square has area 121 cm^2 . Find its side length.

_____ 13) Give the equation of a line with slope 3 and y -intercept $(0, 7)$ in slope-intercept form.

_____ 14) Simplify $(3x^2 - 2x + 4) + (x^2 + 8x + 4)$.

_____ 15) On the graph of $y = 4x^2 + 19$, identify the y -intercept.

_____ 16) Solve $3^x = 27$ for x .

_____ 17) How many metres per hour are equivalent to 8.9 km/h?

_____ 18) Simplify $\left(\frac{16}{25}\right)^{\frac{1}{2}}$.

_____ 19) What is the radius of a circle with circumference 12π ?

_____ 20) If $x = -3$ and $y = 4$, evaluate $x^2 - 2x + 3y$.

Queensland Association of Mathematics Teachers – Rockhampton Branch
Maths Teams Challenge 2020 – Year 11 & 12 Individual Questions

Student 5

Instructions : Calculators are not allowed. Write the answer to each question on the line provided.

_____ 1) $2 \times 7 + 18 \div 6$

_____ 2) $2^2 + 6^2$

_____ 3) Factorise $6x^2 + 2x$ completely.

_____ 4) How many quarters are in $2\frac{1}{2}$?

_____ 5) Simplify $\frac{3}{8} + \frac{3}{4}$ into an improper fraction.

_____ 6) Increase \$500 by 15%.

_____ 7) Solve $\frac{6x + 4}{5} = 2$ for the pronumeral.

_____ 8) Expand $(x + 1)^2$.

_____ 9) Calculate the mean of the values : 6, 2, 13.

_____ 10) $\left(\frac{\sin^2 \theta + \cos^2 \theta}{\tan^2 \theta}\right)^0$

_____ 11) Simplify $\log_3 9$.

_____ 12) A square has area 100 cm^2 . Find its side length.

_____ 13) Give the equation of a line with slope 7 and y -intercept $(0, 6)$ in slope-intercept form.

_____ 14) Simplify $(x^2 - 3x + 1) + (2x^2 + x + 3)$.

_____ 15) On the graph of $y = 6x^2 + 18$, identify the y -intercept.

_____ 16) Solve $2^x = 8$ for x .

_____ 17) How many metres per hour are equivalent to 4.7 km/h?

_____ 18) Simplify $\left(\frac{25}{36}\right)^{\frac{1}{2}}$.

_____ 19) What is the radius of a circle with circumference 6π ?

_____ 20) If $x = -2$ and $y = 3$, evaluate $x^2 - 3x + 4y$.

Queensland Association of Mathematics Teachers – Rockhampton Branch
Maths Teams Challenge 2020 – Year 11 & 12 Individual Questions

Student 1	Answers	Student 2	Answers	Student 3	Answers
1) 25	11) 3	1) 35	11) 4	1) 14	11) 3
2) 13	12) 12	2) 29	12) 9	2) 20	12) 8
3) $8x(3x + 1)$	13) $y = 4x + 8$	3) $6x(3x + 1)$	13) $y = 2x + 3$	3) $5x(3x + 1)$	13) $y = 6x + 9$
4) 9	14) $5x^2 + 2x + 9$	4) 7	14) $9x^2 + 6x + 5$	4) 6	14) $7x^2 + 3x + 4$
5) $\frac{15}{14}$	15) 17 or (0, 17)	5) $\frac{19}{18}$	15) 14 or (0, 14)	5) $\frac{11}{10}$	15) 12 or (0, 12)
6) \$690	16) 4	6) \$345	16) 3	6) \$230	16) 4
7) 7	17) 3800	7) 2	17) 4600	7) 4	17) 5700
8) $k^2 + 10k + 25$	18) $\frac{6}{7}$	8) $d^2 + 8d + 16$	18) $\frac{7}{8}$	8) $z^2 + 6z + 9$	18) $\frac{8}{9}$
9) 10	19) 8	9) 8	19) 5	9) 11	19) 7
10) 1	20) 28	10) 1	20) 24	10) 1	20) 34

Queensland Association of Mathematics Teachers – Rockhampton Branch
 Maths Teams Challenge 2020 – Year 11 & 12 Individual Questions

Student 4 Answers

Student 5 Answers

- | | | | |
|--------------------|---------------------|-------------------|---------------------|
| 1) 49 | 11) 2 | 1) 17 | 11) 2 |
| 2) 53 | 12) 11 | 2) 40 | 12) 10 |
| 3) $7x(3x + 1)$ | 13) $y = 3x + 7$ | 3) $2x(3x + 1)$ | 13) $y = 7x + 6$ |
| 4) 5 | 14) $4x^2 + 6x + 8$ | 4) 10 | 14) $3x^2 - 2x + 4$ |
| 5) $\frac{17}{12}$ | 15) 19 or (0, 19) | 5) $\frac{9}{8}$ | 15) 18 or (0, 18) |
| 6) \$460 | 16) 3 | 6) \$575 | 16) 3 |
| 7) 3 | 17) 8900 | 7) 1 | 17) 4700 |
| 8) $y^2 + 4y + 4$ | 18) $\frac{4}{5}$ | 8) $x^2 + 2x + 1$ | 18) $\frac{5}{6}$ |
| 9) 9 | 19) 6 | 9) 7 | 19) 3 |
| 10) 1 | 20) 27 | 10) 1 | 20) 22 |

Scores

Year

School

Team

Student 1	
Student 2	
Student 3	
Student 4	
Student 5	
TOTAL	

out of 100

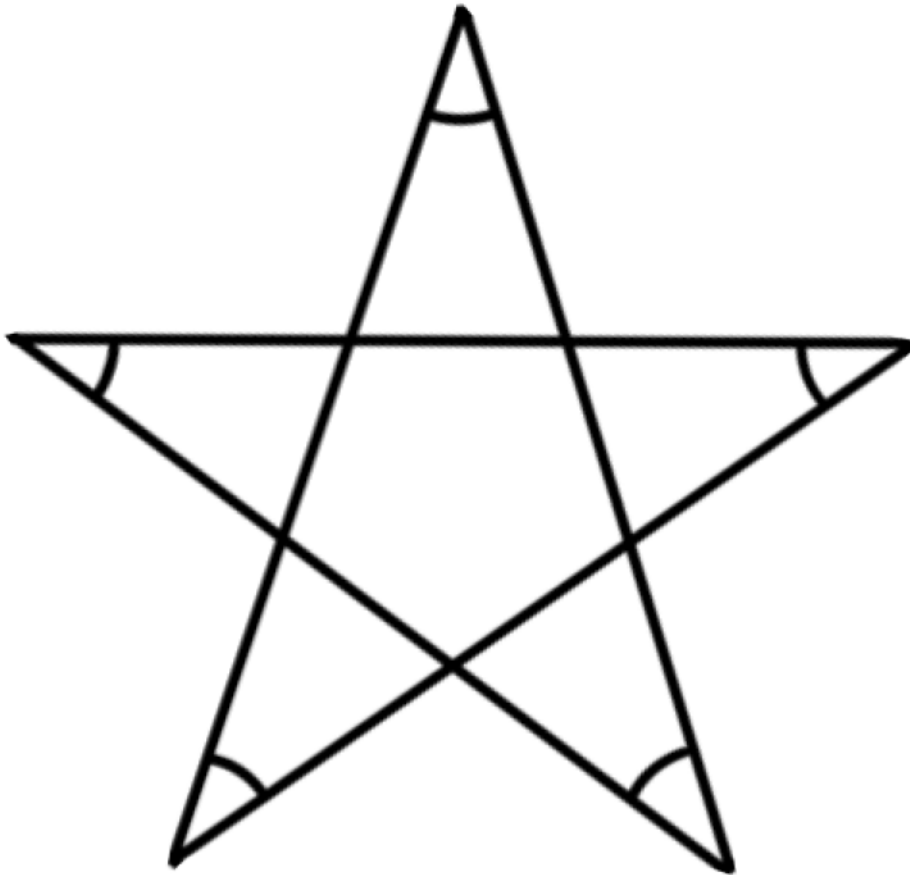
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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

1) Solve for the exact value of x .

$$\sqrt{\frac{1}{\sqrt{x}}} = 3$$

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

2) Find the sum of the angles in this regular pentagram.



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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

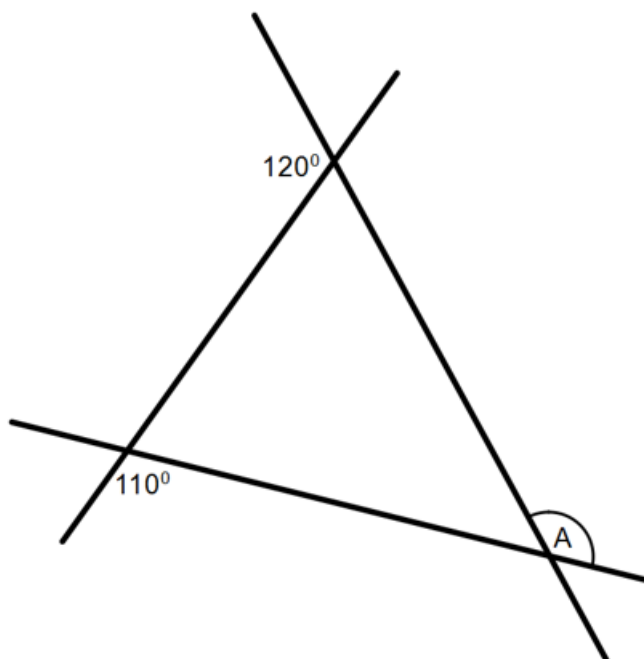
- 3) Determine the time it takes (in hours, minutes, and seconds) for the minute hand on an analogue clock to move through 1234° .

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- 4) A bicycle wheel, with radius 30 cm, makes 1500 revolutions. Determine the exact distance, in metres, that the bike travelled in total.

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5) Calculate the measure of angle A .



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- 6) A cube has a volume of 100 cm^3 . Determine the length of its side, rounded to 2 decimal places.

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- 7) Bob rode his motorcycle 800 metres in 30 seconds. Determine his average speed in kilometres per hour.

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

8) Find the units digit of the product of the first 200 prime numbers.

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- 9) The mean age of five birds is 8 years old. A new bird arrives. The mean age of the six birds is now 9 years old. Determine the age of the new bird.

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

- 10) Identify the smallest positive integer that is divisible by all of the integers from 1 to 10.

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

11) Solve for x .

$$\frac{x}{2 + \frac{3}{4+5}} = 1 + \frac{2}{3+4}$$

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

- 12) Alice and Bob each throw two coins. Determine the probability that Alice throws more heads than Bob. Answer as a fraction in simplest form.

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13) Simplify, giving your answer as a fraction in lowest terms.

$$x\% \text{ of } \frac{1}{x}, \text{ if } x \neq 0$$

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14) Determine the last digit of $(7^5)^3$.

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15) What number must be added to 2^{2019} to get 2^{2020} ?

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- 16) Determine the single percentage discount that is equivalent to getting a discount of 10%, followed by a discount of 20%, followed by a discount of 30%, followed by a surcharge of 5% for paying by credit card. Round your answer to 1 decimal place.

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- 17) The integer n is the mean of three numbers 17, 23, and $2n$.
Determine the value of n

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- 18) The number $A845E$ is divisible by 72, where A and E are the first and last digits, respectively. Identify this five-digit number.

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19) Solve for y .

$$\sqrt{y + 15} + \sqrt{y} = 15$$

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

- 20) I have played 200 games of chess with a success rate of 60%. Determine the number of consecutive chess games I must now win in order to raise my success rate to 75% in the shortest possible time.

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

- 21) Three vertices of a square are $A(2, 3)$, $B(5, 1)$, and $C(7, 4)$. Determine the coordinates of the centre of the square.

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

22) Let $x^2 + 5x + 6$ be a prime number. Determine the smallest integer value of x .

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

23) The binary operation $*$ is defined by

$$a * b = \frac{1}{a} + \frac{1}{b} + ab.$$

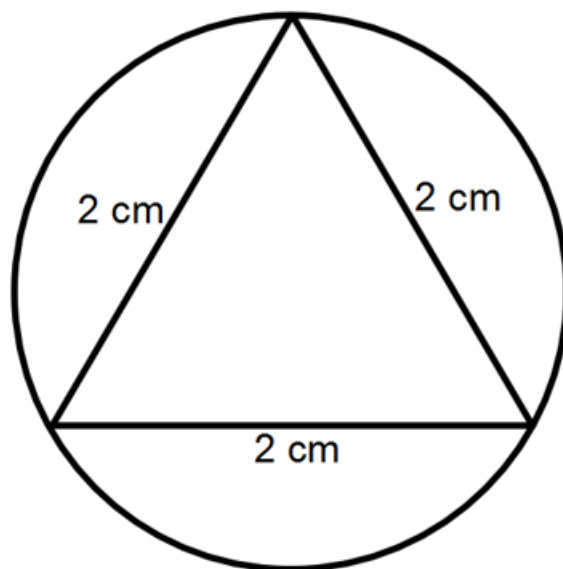
Calculate the exact difference between $\frac{1}{3} * 6$ and $\frac{1}{6} * 3$. Give your answer as an improper fraction in simplest form.

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

- 24) At twenty-five to three, determine the size of the smaller angle between the hands of the clock.

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Maths Teams Challenge 2020 – Year 11 & 12 Relay Questions

- 25) An equilateral triangle with sides 2 cm is drawn circumscribed inside a circle, each vertex on the circumference. Calculate the exact diameter of the circle.



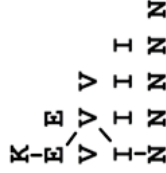
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Year 11 & 12 Maths Teams Challenge 2020 – Relay Questions Answers

Year Level : 11 or 12 (circle one)

School : _____ Team Number : _____

Question	Relay Answers	Attempt	Score
R25	$\frac{4}{\sqrt{3}}$ or $\frac{4\sqrt{3}}{3}$ cm	1 2 3 P	8 6 4 0
R24	132.5°	1 2 3 P	8 6 4 0
R23	$\frac{5}{3}$	1 2 3 P	8 6 4 0
R22	-4	1 2 3 P	8 6 4 0
R21	(4.5, 3.5)	1 2 3 P	8 6 4 0
R20	120 games	1 2 3 P	8 6 4 0
R19	49	1 2 3 P	8 6 4 0
R18	48,456	1 2 3 P	8 6 4 0
R17	40	1 2 3 P	8 6 4 0
R16	47.1%	1 2 3 P	8 6 4 0
R15	2^{2019}	1 2 3 P	8 6 4 0
R14	3	1 2 3 P	8 6 4 0
R13	$\frac{1}{100}$	1 2 3 P	8 6 4 0
R12	$\frac{5}{16}$	1 2 3 P	8 6 4 0
R11	3	1 2 3 P	8 6 4 0
R10	2520	1 2 3 P	8 6 4 0
R9	14 years old	1 2 3 P	8 6 4 0
R8	0	1 2 3 P	8 6 4 0
R7	96 kph	1 2 3 P	8 6 4 0
R6	4.64 cm	1 2 3 P	8 6 4 0
R5	130°	1 2 3 P	8 6 4 0
R4	900π m	1 2 3 P	8 6 4 0
R3	3 hours 25 minutes 40 seconds	1 2 3 P	8 6 4 0
R2	180°	1 2 3 P	8 6 4 0
R1	$\frac{1}{81}$	1 2 3 P	8 6 4 0
Total			

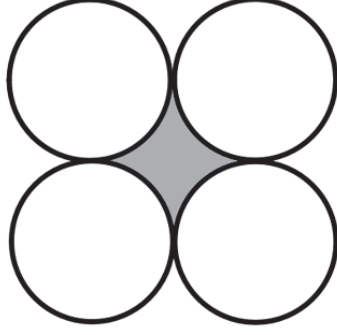
- 1) Determine the number of ways there are to spell KEVIN, starting at K and moving down either vertically or diagonally at 45° . One way is shown as an example.
(10 points)



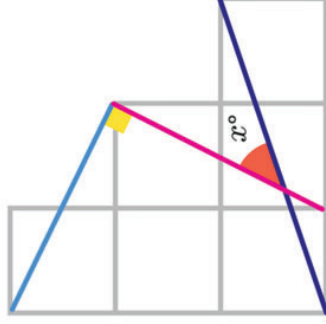
- 2) 2520 is the smallest positive number that has all integers from 1 to 10 as factors. What is the smallest positive number that has all of the integers from 1 to 20 as factors?
(10 points)
- 3) Fill in the nine squares according to the following limitations.
 * Each value is a prime number.
 * The product of the three numbers in each row equals the number at the end of that row.
 * The product of the three numbers in each column equals the number at the bottom of the column.
(10 points)

			182
			130
			266
98	338	190	X

- 4) Each circle shown has a radius of 1 cm. Determine the area of the shaded region, rounded to 1 decimal place.
(10 points)



- 5) Five different numbers are chosen at random from the numbers 1 to 100. The first number chosen is a , the second is b , the third is c , the fourth is d , and the fifth is e . Find the probability that $a < b < c < d < e$. Answer as a fraction in simplest form.
(20 points)
- 6) Determine the size of angle x . Note : The grey boxes are all squares.
(20 points)



- 7) Some students are weighing marbles in a can.
 * 5 blue marbles and 7 red marbles including the can is 84 grams
 * 5 red and 7 blue marbles including the can is 82 grams
 * 1 blue and 2 red marbles together weigh the same as the can
 How many grams does the can weigh?
(20 points)

8) There exists a number such that

- * the first digit is the number of ones in the number;
- * the second digit is the number of twos in the number;
- * the third digit is the number of threes in the number; and so on, up to
- * the tenth digit, which is the number of zeros in the number.

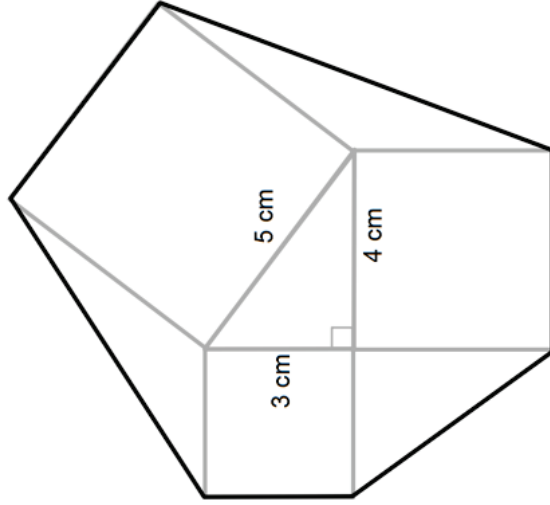
Identify this ten-digit number.

(30 points)

9) Squares are drawn on the sides of a triangle with sides 3cm, 4cm, and 5 cm.

The vertices of the squares are joined to make a hexagon as shown. Find the area of this hexagon. Round your answer to 1 decimal place.

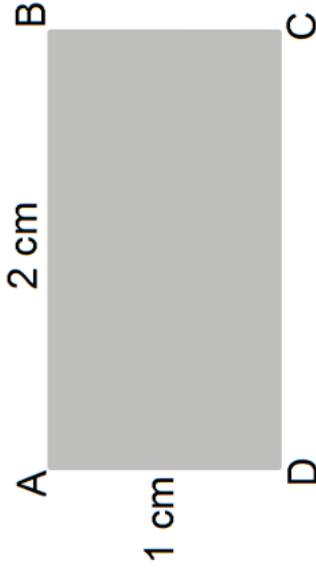
(30 points)



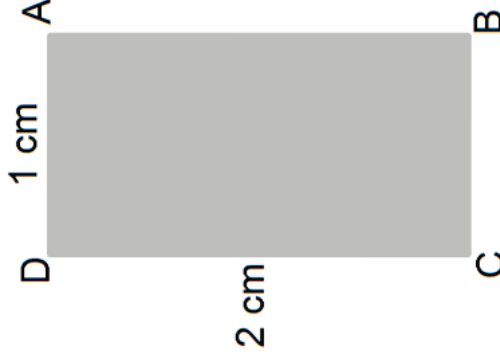
Hint : The area of a triangle where a and b are the lengths of two sides of the triangle and C is the angle between these two sides is given by the formula

$$A = \frac{1}{2}ab \sin C.$$

10) Rectangle $ABCD$ measures 2 cm by 1 cm.



It is rotated 90° clockwise about C , without slipping, until it is in this position.



We continue this process, rotating about B , then A , then D , until A is back in the upper left corner of the rectangle. How far has point A travelled in total? Give the answer in centimetres, rounding to 1 decimal place.

(30 points)

Queensland Association of Mathematics Teachers – Rockhampton Branch
 Year 11 & 12 Maths Teams Challenge 2020 – Team Questions Answers Sheet

Year Level : 11 or 12 (circle one)

School : _____ Team Number : _____

Question	Answers	Score	Points																
T1			10																
T2			10																
T3	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td></td> <td></td> <td>182</td> </tr> <tr> <td></td> <td></td> <td></td> <td>130</td> </tr> <tr> <td></td> <td></td> <td></td> <td>266</td> </tr> <tr> <td>98</td> <td>338</td> <td>190</td> <td>✗</td> </tr> </table>				182				130				266	98	338	190	✗		10
			182																
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98	338	190	✗																
T4			20																
T5			20																
T6			20																
T7			20																
T8			30																
T9			30																
T10			30																
Total																			

out of 200

Estimation Event Response : _____

Queensland Association of Mathematics Teachers – Rockhampton Branch
 Year 11 & 12 Maths Teams Challenge 2020 – Team Questions Answers

Question	Answers	Points																
T1	35	10																
T2	232,792,560	10																
T3	<table border="1" style="margin: auto;"> <tbody> <tr> <td>7</td> <td>13</td> <td>2</td> <td>182</td> </tr> <tr> <td>2</td> <td>13</td> <td>5</td> <td>130</td> </tr> <tr> <td>7</td> <td>2</td> <td>19</td> <td>266</td> </tr> <tr> <td>98</td> <td>338</td> <td>190</td> <td>✕</td> </tr> </tbody> </table>	7	13	2	182	2	13	5	130	7	2	19	266	98	338	190	✕	10
7	13	2	182															
2	13	5	130															
7	2	19	266															
98	338	190	✕															
T4	0.9 cm^2	20																
T5	$\frac{1}{120}$	20																
T6	45°	20																
T7	17 grams	20																
T8	2,100,010,006	30																
T9	74 cm^2	30																
T10	8.2 cm	30																
Total		200																

Queensland Association of Mathematics Teachers – Rockhampton Branch
Maths Teams Challenge 2020 – Year 11 & 12 Shoot Out Questions

Round 1

1. Give the first six digits of the number pi.
3.14159
2. Give the geometrical name of half a sphere.
a hemisphere
3. Correctly spell the word hypotenuse.
hypotenuse
4. Give the supplementary angle to 82 degrees.
98
5. Compute the square root of 225.
15
6. Define the relationship between two parallel lines.
they will never cross or they have the same slope but different y-intercepts
7. State the coordinates of the origin on a Cartesian coordinate plane.
(0, 0)
8. Convert 15,000 into scientific notation.
 1.5×10^4
9. Convert two centimetres to metres.
0.02
10. What characteristic allows a polygon to be a 'regular' polygon?
The sides are all the same length.
11. State the Pythagorean Theorem.
 $a^2 + b^2 = c^2$
12. Add three fourths and five eighths, giving your answer as an improper fraction.
 $\frac{11}{8}$
13. As a roman numeral, C is equivalent to what value?
100
14. Correctly spell the word isosceles.
isosceles
15. List the three basic trigonometric functions.
sine, cosine, and tangent
16. Convert 6 pm into 24 hour time.
18:00
17. One million has how many zeros?
6
18. Compute four cubed.
64
19. A regular heptagon has how many sides?
7
20. Give the reciprocal of five twelfths.
 $\frac{12}{5}$

Queensland Association of Mathematics Teachers – Rockhampton Branch
Maths Teams Challenge 2020 – Year 11 & 12 Shoot Out Questions

Round 2

1. Three dozen is equivalent to what numeric value?
36
2. When dividing 123 by 12, what is the remainder?
3
3. State the quadratic formula.
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
4. On the Cartesian coordinate plane, does the y -axis run vertically or horizontally?
vertically
5. Between which two positive whole numbers is the square root of 21?
4 and 5
6. Give the complementary angle to 36 degrees.
54
7. The highest power in a quadratic polynomial is . . .
2
8. When going at a speed of 6 km/h for 210 minutes, how many kilometres would have been travelled?
21
9. Name the polygon with 12 sides.
a dodecagon
10. The central angle of an eighth of a circle is what measure?
45
11. Name the polynomial type with 3 as its highest power.
a cubic
12. Add 23 cm and 90 mm, giving your answer in centimetres.
32
13. As a roman numeral, IX is equivalent to what value?
9
14. Correctly spell the word circumference.
circumference
15. Calculate the perimeter of a rectangle that is 1.5 cm by 2.5 cm.
8
16. Turning clockwise on a compass, SE is how many degrees from N?
135
17. True or False : The Prime Meridian is a line of latitude.
false
18. If a 20 dollar note is used to pay for something that costs \$4.50, how much change would be expected?
15.50
19. What is the probability of something that is certain to happen?
1
20. How many faces does a cube have?
6



Queensland Association of Mathematics Teachers
Rockhampton Branch

Maths Teams Challenge

name

from _____

school

participated at this competition in Year _____

date



Queensland
Association of
Mathematics
Teachers

Rockhampton Branch

This is to certify that

supervised at the Year 11 & 12 Maths Teams Challenge
incorporating engaging mathematical activities.

AITSL Standard 3 – Plan for and implement effective teaching and learning
AITSL Standard 7.4 – Engage with professional teaching networks and broader communities

2.5 hours of professional development

date

Suella Lye
President