

FastTrack RC

A NASCAR Youth Initiative



Grades 6 - 12
Booklet #1

National STEM League Handbook

As a part of the FastTrack RC National STEM League, your team will earn points for competing in race events, investigating, designing & developing, building public relations and managing team efforts.

This FastTrack RC STEM League handbook includes rules & guidelines, season schedule, points system, forms, track layouts and more.

Teams should understand, sign and return the FTRC Rules & Guidelines with their annual registration form.

Good luck. May you keep the sunny side up!



1-877-math2go (628-4246)
info@ten80education.com
www.FastTrackRC.com
www.Ten80Education.com

Not just faster ... Go further, faster. That is the FastTrack Racing Challenge. A FastTrack RC race takes only hours; preparing for it takes weeks of data collection, analysis, creative engineering, management and marketing. All of these activities, critical for professional success, are worth points in the FTRC National STEM League, a little league for future professionals.

Points Race: Between October and May, teams earn points in a variety of ways that represent the broad range of industry skills from applied math and creative engineering to preventative maintenance, marketing, graphic design and management. Details are outlined in the Introduction & Points System sections.

Annual National Finals: At the FTRC Finals, teams compete in six of seven categories including four race events, team marketing presentation, creative engineering project, alternative energies research and graphic design. Details are provided in the Introduction section.



Log into the FastTrack RC Team Web Site to connect with other teams and for additional resources like videos, presentations and focus lessons.

Share an Intro to FastTrack RC Video at <http://www.FastTrackRC.com>



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FastTrack RC Philosophy & Objectives



Philosophy & Mission

The performance halls of math, science, engineering and technology (STEM) are factories, design houses and offices of the workplace. We cannot expect students to stroll onto these stages and perform at a professional level before ever having played the game. All professionals must practice their art, craft or sport to succeed. STEM professionals are no different.

The FastTrack Racing Challenges (FTRC) League increases interest in STEM careers, improves achievement in STEM subjects and helps youth improve critical thinking and problem-solving skills through the active application of science, math and engineering through the use of technology.

The FTRC is a 'little league' for future professionals and it achieves this mission by connecting students, K-12 educators, universities & colleges, government and industry partners. It was initiated in a late 1990's National Science Foundation grant in which the investigators were tasked with integrating differentiated, problem-based learning into the classroom. It was at the cutting-edge of today's movement toward project-based learning and the RC car was the stand-out tool because it can reach struggling students and high achievers alike.

Today's FTRC is the product of over 10 years of curriculum, network and resource development by industry professionals, teachers, community leaders and of course...enthusiastic students.

Share the FTRC with others in your community using materials available for download at www.FastTrackRC.com and your team web site.

Objectives

Operational partners and supporters in FastTrack RC League help youth understand and develop their personal and professional potential. FastTrack RC teams and regions:

- Enhance students' attitudes toward STEM subjects and careers
- Improve STEM content knowledge and skills critical for success in higher education and the workplace; help students translate classroom learning to relevant life experiences
- Foster teamwork and confidence
- Facilitate effective relationships between STEM professionals and youth

FastTrack RC National STEM League



How does it Work for Students?

The FastTrack RC National STEM League is the 'little league' through which future engineers, scientists, marketing and creative professionals prepare for their futures. In the FastTrack RC, middle and high school students form teams around a 1:10 scale RC car that mirror professional motorsports teams, design engineers and 'green' transportation designers.

Schools and community groups implement the FastTrack RC as a STEM club, pre-engineering/technology modules, applied science and math activities and summer camps.



FTRC Points Race: Oct - May

Between Oct-May, student teams compete in races and the following project categories to earn points.

- FTRC Race Events
- Aerodynamic Design Projects
- Chassis Set-Up Investigations
- Mechanical Engineering Projects
- P.I.T. Now! Alternative Energy Projects
- Automation & Programming
- Marketing & Public Relations
- Project Management
- Graphic Design (logo, car decal scheme)

National FTRC Finals: May

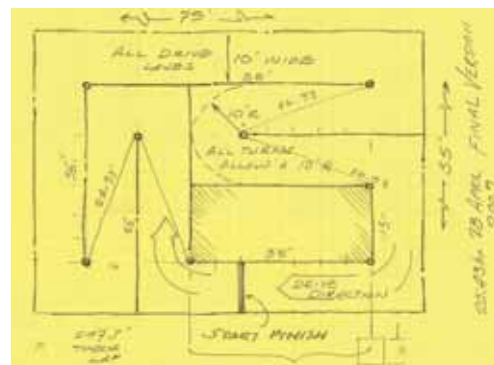
Points leaders and category winners compete in at least 7 of the following categories at the National FastTrack RC Finals held at a NASCAR track:

1. Race Events (200 points)
2. Endurance Event (100 points)
3. Aerodynamic Design Race Event (100 points)
4. Creative Engineering Projects (100 points)
5. P.I.T. Now! Alternative Energy Projects (100 points)
6. Team Presentation (100 points)
7. Logo Design (100 points)
8. Car Decal Design (100 points)

What is a FTRC Race Event?

Teams layout one of the standard tracks in a parking lot or gym. Event scores reward teams for going further and faster by optimizing these and other performance variables just like the professional race teams:

- Energy source (renewable) & efficiency
- Gear ratio & chassis geometry
- Strength:Weight ratios
- Aerodynamic drag & down-force



Examples FastTrack RC Activities:

The first step to "engineering performance" is learning to quantify performance. In *Hit Your Mark*, students collect data and make graphs to illustrate their 'learning curve' toward, fast, consistent driving.

SCIENCE. *Traction:* Use Newton's Laws of Motion and a skid pad test to calculate the coefficient of friction then use that value to find the top speed around a curve.

MATH. *Track Layout:* Laying out FTRC tracks in a gym or parking lot is an applied geometry lesson.

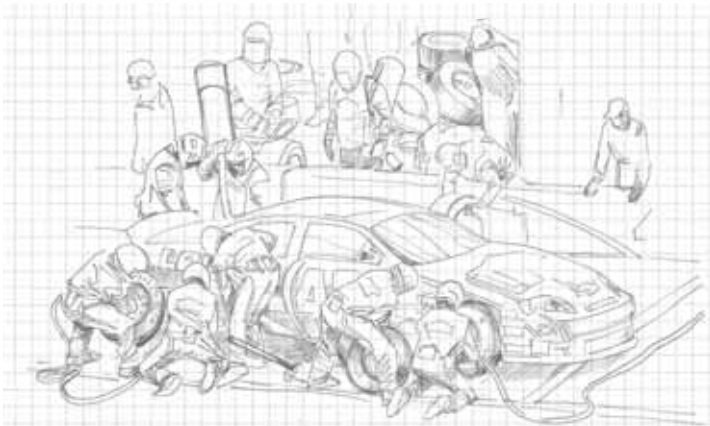
Math Modeling: Teams collect data and create math models to optimize performance variables.

TECHNOLOGY. *Design on the FastTrack:* Students use SolidWorks, a leading 3-D CAD program with a virtual wind tunnel, to design a more aerodynamic car body.

ENGINEERING: When students apply math, science and technology to solve a problem, as they do in every *Chassis Set-Up Investigation, Aerodynamic Project and Mechanical Engineering Project*, they are engineering a solution.

The Professional Race Team + *Example Support Businesses*

Race Day



When drivers are on their marks, races are won and lost by the Pit Crews. The Crew Chief decides what will change and when to change it. They can add gas, change 4 tires, insert a spring wedge, give the driver water and clean the window all in under 9 seconds ... 10 seconds may mean losing the race.



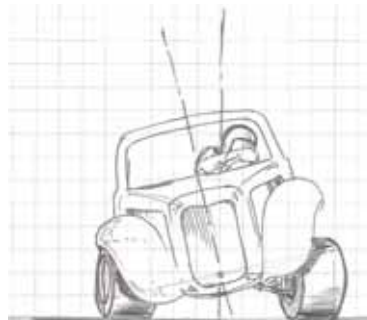
They aren't playing video games in the 'War Wagon'. They're 'crunching numbers' on lap times to see if the car can win. Only a 0.25 second change in lap time can tell the engineers something's got to change. Perhaps the springs are too loose and need a wedge insert. Do you have time for 4 or only 2 tire changes? The answer is in the numbers.

Events

Legal • Accounting

Track Facilities

Banks



Drivers Communicate how the car is handling. They must "Hit Their Marks" every time!

The glory goes to the drivers and Pit Crew you see on TV, but those people would never have jobs if it weren't for the Executive and operational people behind the scenes. Racing, like football and baseball, are marketing and entertainment industries above all else. The majority of people working in a race team are in this industry, not 'racing'.

- Race teams only exist if they have financial sponsors. Teams must present to potential sponsors constantly and sell merchandise to pay the bills. Once the money comes in, accountants help make good use of it.
- Sponsors pay only if they think race teams can get them public exposure. To do that, teams of people are putting on events, designing logos, products and gimmicks to get YOUR attention. Didn't know you were so popular, did you?
- To pull all of this together, executives like Presidents and Vice Presidents are constantly making calculations and building strategies ... strategies to win races and to win the public relations game. Managers are in charge of putting those strategies into action successfully. That takes a lot of planning and coordination.

Race Engineering

Wind Tunnels

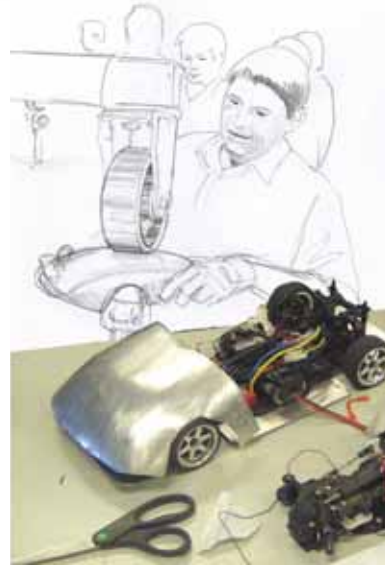
Part Manufacturers

Paint Companies

Once at the track, there are only a few things you can change to race better. 95% of the work for each race is done before ever leaving the shop!

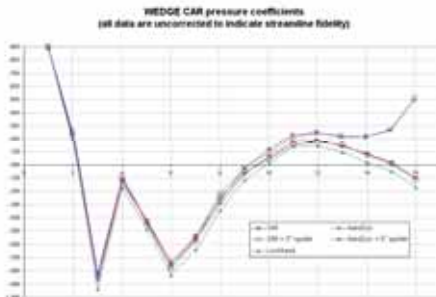


Engineers investigate performance to get data and make decisions on setup and modifications. They use tools like 7-post rigs to get suspension data, wind tunnels to get aerodynamic data and even occasionally, road testing with the driver.



Mechanics, machinists and other fabricators make and install custom parts based on engineer's decisions.

For all data, their favorite analysis tool is a spreadsheet. Really.



Business, Management, Marketing & PR

Advertising

TV • Radio
Photo • Web

Graphic Design



Sponsors

Merchandise Companies

FTRC Points Race Summary

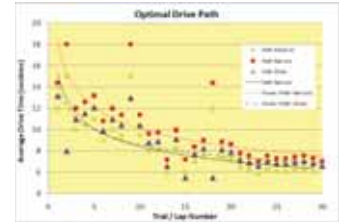
Oct - May

Between Oct and May, FastTrack RC teams earn points through activities representing a broad range of industry skills. Details are in the Points System section.

- Race Events & Monthly Challenge**
- Face-2-Face Events (varies, ~300 each)
 - Web Races (varies, ~300 each)
 - Monthly Challenges (varies, ~200 each)



- Race Engineering**
- Chassis Setup Investigations (100 ea.)
 - SolidWorks Designs (100 ea.)
 - Aerodynamics Projects (200-400 ea.)
 - Mechanical Design Proj. (200-400 ea.)
 - P.I.T. Now Alt. Energy Proj. (200-400 ea.)



- Business & Project Planning**
- Team Business Plan (400-500 ea.)
 - FTRC Team Project Plan (200-400 ea.)
 - Sub-Team Project Plans (100-200 ea.)
- ex. Aerodynamic, Creative Engineering, etc.*

Task Name	W000	W005	W1000	W2000	W2500
Team Manager					
Track Team & Period					
Assign Project Roles					
Task Team Goals & Commitments					
Customer Team Selection					
Team Progress - Narrative Notes					
Client Financial Outlook					
Revenue Team Goals					
Revenue Team Performance					
Marketing & Financial Outlook					
Task Funding Goals					
Plan Fundraising & Sponsorship Campaign					
Track Fundraising and Sponsorship Outlook					
PR Career Math & Physics Exports					
Writing Project Plan					
Final Project Plan					
Transition					

- Media Professional / Non-Professional**
- Print & Web Articles (10/20 per 100 words)
 - Video Reports (100/50 per 30 seconds)
 - Audio Reports (100/50 per 30 seconds)
 - Professional Reprints (10 per 100 words)
 - Blog Mentions (30/15 per entry)
 - Published Pictures (30/15 per iteration)

FEATURE STORY

LEARNING MADE FUN
MOTORSPORTS INSTITUTE SUMMER CAMP

"I've been interested in motorsports since I attended my first NASCAR race two years ago. My Mom was always a fan, and I never understood. Now I do. I'd love to have a career. I'd love to be in marketing and publicity supporting a really great driver."

- Gabby Lopez, Motorsports Institute Summer Camp

The car gets loose coming full speed into the first turn. Gabby Lopez, as the co-creator, quickly reacts and the car jukes up speed to the straight away only to drift far off the track on the next turn. Driving only a little more cautious, she makes it across the finish line to complete the first of her two laps. She laughs and her team cheers a few seconds later as the 1:30 scale, remote control, Capri RC race car completed the real race competition on the final day of the Motorsports Institute Summer Camp hosted by The North Carolina Motorsports Association in partnership with the Society of Manufacturing Engineers Education Foundation.

- Web Sites & Networking Sites**
- Web Site Design (200-400)
 - Networking Sites (2 / 10 followers)
 - Web Links from other sites (40 / link)



- Team Identity & Public Relations**
- Team Identity Design (200-400)
 - PR Materials (50-200 per item)
 - PR Strategy & Plan (100 - 200)



Car Decal Design (Deadline April 1st, 100 - 200 points)



FTRC Annual National Finals Summary

Regional FastTrack STEM Centers host regional finals in April. Winner compete in Nationals each May.

Who Competes: Regional & Points Race winners are invited to the National Finals held at a NASCAR track. Download the event guide with full details at the FTRC team web site.

Venue: National Finals is at a NASCAR track announced each Fall. Regional events held at partner venues like race tracks, arenas and campuses.

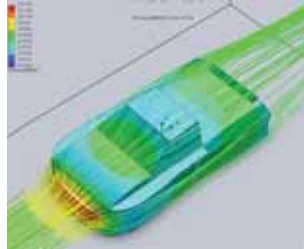
Challenges: Teams compete in at least 7 of the 8 competition categories shown here.

Duration: 6 hours including practice, competition, scoring and awards

1. Race Events
(200 points)



2. Aerodynamics
(100 points)



3. Alternative Energy Project (200 points)



4. Visual Design
(200 points)



5. Creative Engineering Project (200 points)



7. Team Presentation
(200 points)

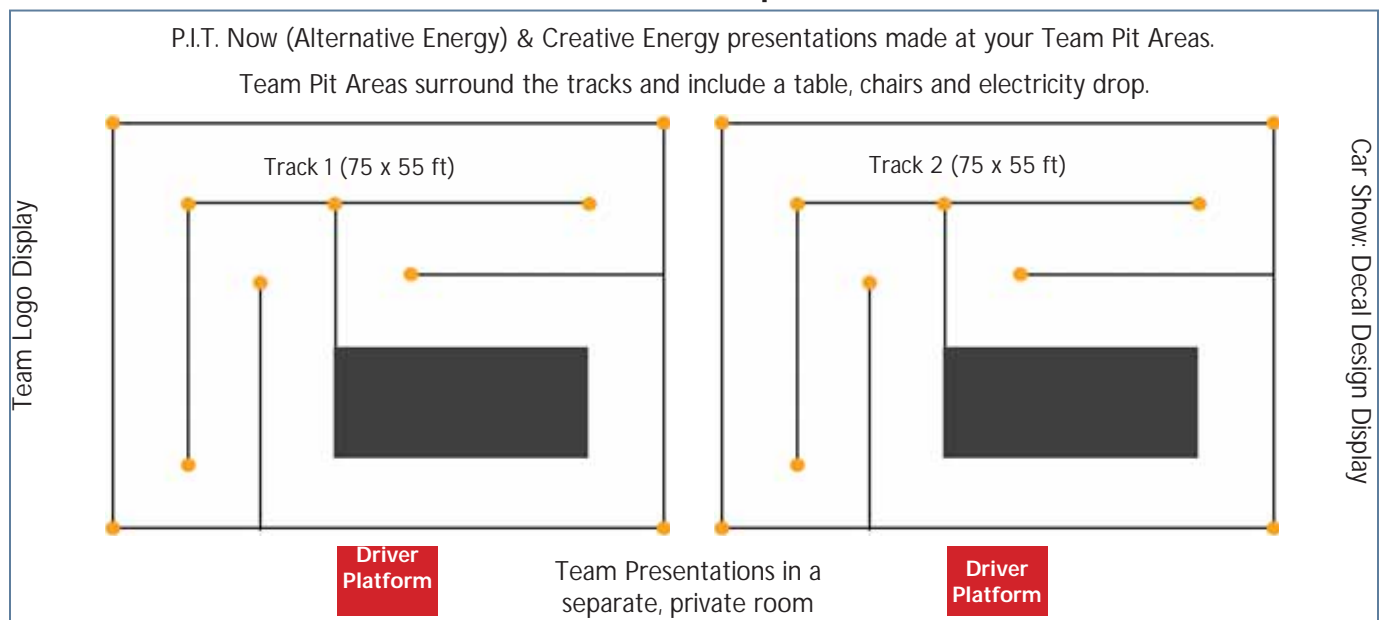


8. Endurance Race
(200 points)



General Floorplan

P.I.T. Now (Alternative Energy) & Creative Energy presentations made at your Team Pit Areas.
Team Pit Areas surround the tracks and include a table, chairs and electricity drop.



FTRC Regional Calendar

JUNE → JULY

SU	M	T	W	TH	F	SA
Professional Development Institutes						
						

AUGUST

SEPTEMBER

SU	M	T	W	TH	F	SA
10 New FTRC Teams						
						


OCTOBER

SU	M	T	W	TH	F	SA
Season Kick-off Event						
						

NOVEMBER

SU	M	T	W	TH	F	SA

DECEMBER

SU	M	T	W	TH	F	SA
Local Points Race						
						

FTRC Points Race October - May

Monthly Mentor Visits * Classroom Activities * Club Meetings * Competitions

JANUARY

SU	M	T	W	TH	F	SA

FEBRUARY

SU	M	T	W	TH	F	SA
Local Points Race						
						

MARCH

SU	M	T	W	TH	F	SA

APRIL

SU	M	T	W	TH	F	SA
Regional Finals						
						

MAY

SU	M	T	W	TH	F	SA
National Finals						
						

JUNE → JULY

SU	M	T	W	TH	F	SA
Summer Camps						
						

FTRC 2010-11 Season Schedule

Award or Event	Date / Deadline	Points
Submit Race Engineering investigations/projects	Oct - May	Varies
Submit results from Sanctioned FTRC Race Events	Oct - May	Varies
Submit Project Plans	Oct - May	Varies
Submit Press Coverage, Media Exposure	Oct - May	Varies
Submit Web Sites & Growth of Networking Sites	Oct - May	Varies
Submit Public Relations Materials and Plans	Oct - May	Varies
Most Points in October, 2 teams	Oct 31	50, 100
Most Points in November, 2 teams	Nov 30	50, 100
Most Points in December, 2 teams	Dec 31	50, 100
Most Points in January, 2 teams	Jan 31	50, 100
Most Points in February, 2 teams	Feb 28	50, 100
Most Points in March, 2 teams	Mar 31	50, 100
Most Points in April, 2 teams	April 30	50, 100
Submit Car Decal Design	April 1	Tiered Awards
Team Business Plan submission deadline	April 1	Tiered Awards
Team Project Management submission deadline	April 1	Tiered Awards
Invitations to Annual National Finals sent out	TBA (April)	NA
Accept Invitation to Annual National Finals	TBA (April)	NA

Starting a FastTrack RC Team

Supplemental Math, Science, STEM • Summer Camp • After-School



Who is on a FTRC Team?

Though STEM mentors are highly suggested for all teams, anyone can form a team whether or not there is a background in STEM. A team can be formed from a school class, after-school program, extracurricular group, home school, neighborhood group, club, or civic organization.

An organization can enter one or up to six teams in the FTRC National STEM League. Successful teams usually consist of between 4 - 10 students in grades 7 - 12 and at least one adult coach. An adult coach can coach multiple teams, but a child can be on only one team. Teams can include these roles:

- Team manager
- Race Engineers, Math and Physics 'Experts'
- Driver and Chief technician
- Machinists / Fabricators
- Web Design & Video Editing
- Graphic Designer
- Marketing & Public Relations Director
- Programmer
- Chief Financial Officer & Fund-raiser

Year 1: Non-Consumable Base Kit

FastTrack RC teams get started by purchasing the FTRC Base Kit that includes the following materials and entries for up to two teams from one organization.

- 2 x 1:10 Scale RC cars, controllers and storage bins
- 2 x rechargeable batteries and 2 x smart battery chargers
- 2 x Stopwatches, 2 x tape measures, soldering iron, multi-meter
- 4 x Extra gear sets, 2 x Foam tires sets and other misc. spare parts
- Chassis Geometry setup board
- SolidWorks® Student Edition (1-year)
- 2 x Team entries into the FTRC National STEM League (first annual)
- Print & Downloadable STEM Curriculum for middle and high schools

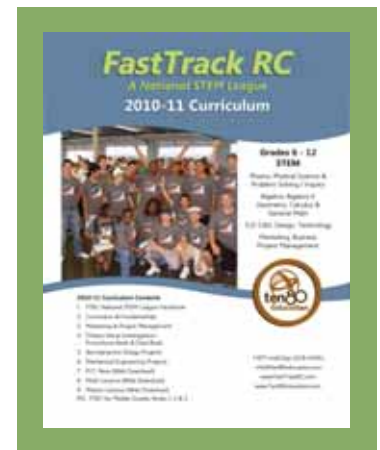
With the Base Kit (~\$2,000), an organization can enter one or two teams. Add Booster Stations (\$589) to enter more teams and engage more students. Teams seek sponsors for uniforms, materials, travel, training and for additional materials (See suggested materials list, \$100-300).

Team Partners & Mentors

Even before receiving your materials and curriculum, you can begin forming partnerships with team mentors and sponsors. Local manufacturing and technology companies, chambers of commerce, professional organizations, colleges, universities and technical schools are ideal candidates.

Years 2, 3, 4.....

The kit is NOT consumable based so teams only have to pay the annual league entry fee of around \$400 for the first team and \$100 for each additional team. Teams reuse the base kit each year, replacing only missing or broken parts and adding technology to expand team capabilities. See the optional parts list for details.





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Sanctioning Official Signature

By signing below, I certify that I have read and understand the rules and guidelines outlined in this document. As a Sanctioning Official, I will enforce the rules outlined in this document in a way that is fair to all participating teams and students as well as non-participating teams and students. I will foster a sense of collaboration as well as friendly competition as teamwork is one of the most critical skills that any student can learn and exhibit.

Name (Print): _____

School / Org: _____

FTRC Team Name: _____

Signature _____

Date _____

Return the signed form and initialed pages of these Rules & Guidelines to the FastTrack RC League Sanctioning Body, Ten80 STEM Center.

Fax: 518-533-3804

Ten80 STEM Center

26F Congress St. #338

Saratoga Springs, NY 12866



1. Overview

The FastTrack Racing Challenges (FastTrack RC, FTRC) is a National STEM League, supplemental STEM (STEM = Science, Tech, Engineering and Mathematics) curriculum, after-school club and summer camp.

Students in grades 6 – 12 form FastTrack RC teams that mimic professional motorsports teams. These student teams compete in the National FastTrack RC STEM League that begins in October and ends in May of each year. They claim points by submitting a form and evidence of work or events to the national sanctioning body via web site entry, email, fax or mail. Points leaders in April are invited to the National FastTrack RC Finals Competition at a NASCAR-Class Speedway in May.

The *FTRC Points Race* rewards teams for commitment and achievement. Teams earn points for doing jobs required in most professional projects and businesses:

- Sanctioned Races: Local, Face-to-Face
- Sanctioned Races: Internet, synchronous
- Monthly Challenges (asynchronous)
- Chassis Set-Up Investigations
- Aerodynamic Design Projects
- Mechanical Design & Fabrication Projects
- Creative Engineering & Alternative Energy Projects
- Project Management
- Public Relations & Marketing
- Visual Design & Web Design

Sanctioned Races: FTRC teams meet face-to-face or over the internet any time during the season. The key to winning races is effective, clever race engineering and consistent driving under pressure. Prior to every event, teams agree on the score class, event schedule, track layout and surface.

In a face-to-face event, the host team lays out one of 10 possible tracks that all teams use. In a web-based event, long-distance competitors agree on a similar driving surface and layout the same track at their own facilities.

There are two classes of FTRC Sanctioned Races: Standard and Pro. "Pro" competitions have a more complex score and therefore are worth more points to participating teams.

Monthly Challenges: These challenges are distributed via email and posted on the team web site. They are asynchronous meaning teams do them at any time between their release and the deadline. A challenge may be a race event to run as a time-trial or may be an investigation or short project.

Teams participating in the *FTRC National Finals* compete in 7 out of 8 of the following categories. Each team is required to enter the Race Events and 6 others.

1. Race Events (300 points)
2. Endurance Race (100 points)
3. Aerodynamic Body Design (100 points)
4. Creative Engineering Project (200 points)
5. P.I.T. Now! Alternative Energy Project (200 points)
6. Team Presentation (200 points)
7. Team Logo (100 points)
8. Car Body Decal Design (100 points)

The League Sanctioning Body is Ten80 STEM Center. Specific questions regarding the interpretation of these rules may be directed in writing or via email to:

FastTrack RC STEM Center
26F Congress St. #338
Saratoga Springs, NY 12866

email: fasttrack@ten80education.com
toll free: 1-877-Math2Go (628-4246)
Fax: 1-518-533-3804

2. Teams

Student teams can be comprised of any K-12 student in good standing plus an adult coach. A student team may be comprised of students from more than one school and team members may change throughout the season as points are awarded to the team car and not to individuals.

Teams will benefit from also partnering with professional mentors. See the regional organization plan for more guidance on recruiting mentors and documenting commitment in a memorandum of understanding.

Teams must return the registration form to register their car(s) with the league.

3. Funding & Team Sponsorships

Once an FTTC team has the base competition kit (2-stations), only minimal additional funding is needed to purchase replacement parts for the cars. However, teams are encouraged to seek additional funding for travel, events, uniforms, prizes, marketing materials and other tools and incentives. Ten80 STEM Centers are available to partner on grants that will fund team activities. See the FTTC team fundraising document for guidance.

Points are awarded to teams that generate a business plan and presentation as well as public relations strategy, plan and materials to help seek funding from local or regional sources. Sample business plan sections and public relations materials are provided in the *Business Planning, Project Planning & Public Relations* booklet and web section.

The NASCAR Foundation offers teams the opportunity to fundraise through their national PIN program. A portion of funds raised by selling pins is donated to the FTTC League and your team. Contact your Ten80 team representative for information and to enroll.

4. FTTC STEM League Points Race

Claiming Points

The official FastTrack RC season is from October to May. Teams can earn points anytime throughout the season by competing in sanctioned races and engaging in activities critical to most successful projects and businesses (non-racing points) like marketing and project management. The categories of possible points are outlined in this section and in the *STEM League Handbook, Points System* section.

Submitting Points: There are three main ways to claim points your team has earned. They are:

1. Use e-form on FastTrack RC Web Site to enter required info and upload documentation
2. Download PDF forms, complete then email with documentation to fasttrack@ten80education.com
3. Fax documentation and completed copies of paper forms from the STEM League Handbook.
4. Mail documentation and completed copies of paper forms from the STEM League Handbook.

FastTrack Racing Challenges Points Categories

Details for each category provided in *FTRC Points System* section in *FTRC STEM League Handbook*.

FTRC Points: One-Time Awards			
Points Category	Points Form to Submit	Action	Points
Participation	<i>Monthly Leaders</i>	Points are awarded at the end of Oct, Nov, Jan, Feb and March to the teams that accumulated the most points that month.	100
Race engineering through investigations and projects	<i>Chassis Setup Investigations</i>	Complete any of the formal investigations in the Chassis Setup Investigation Booklet then submit your data set and points form.	100
	<i>SolidWorks Tutorial Design</i>	Install SolidWorks and take the tutorial(s). Submit your first complete SolidWorks design for points (designs will vary).	100
	<i>Aerodynamics Design Projects</i>	Complete any of the formal projects in the Aerodynamics Design Projects Booklet then submit images of your product, data from your investigations/design and points form.	200 -400
	<i>Mechanical Design Projects</i>	Complete any of the formal projects in the Mechanical Engineering Design Booklet then submit images of your product, data from your investigations/design and points form.	200 -400
	<i>P.I.T. Now Projects on Alternative Energy</i>	Research and make a presentation on your ideas for using, scaling and integrating sustainable energies into our transportation systems. See an introduction and suggested topics in the electronic FTRC Booklet, P.I.T. Now.	200 -400
Business Planning	<i>Business Plan</i>	Create a business plan document and business plan presentation (video evidence). Sample sections are in the <i>Business Planning, Project Planning & Public Relations</i> book.	400 -500
Project Management	<i>Project Management</i>	Build your own team plan then submit it. Make up your own format or use the examples and optional forms from the <i>Business Planning, Project Planning & Public Relations</i> book.	200 -400
Public Relations (PR) Guidance in <i>Business Planning, Project Planning & Public Relations</i>	<i>Team Identity</i>	Create a team logo & color scheme.	200-400
	<i>Web & Networking</i>	Build a public web site for your team.	200-400
	<i>PR Materials</i>	Make a flier, business card, etc.	100-200
	<i>PR Strategy & Plan</i>	Document your PR strategy and plan.	100-200
	<i>Car Body Decal Design</i>	Design your car body decals then submit it for points. Points awarded for submitting an entry and top 4 designs.	200-400

FTRC Points: Recurring Points (Get as many as you can as often as you can)			
Points Category	Points Form to Submit	Action	Points
Sanctioned Races	<i>Race Results Reporting</i>	(1) Face-2-Face Events and/or (2) Synchronous Internet Races. A sanctioning official reports results for all participating teams; each team must review posted results for accuracy.	Varies; See <i>FTRC Points System</i> for Details
Monthly Challenges	<i>Monthly Challenge</i>	Complete challenge as directed in the monthly release via email and post on the team web site. Submit the data, video or photos if required and points form.	
Professional & Non-Professional Media	<i>Media Exposure</i>	Get public exposure for your team and sponsors through professional (news, TV, radio, web) and non-professional (PTA) media	
Social Networking Sites	<i>Web & Networking</i>	Get others to link to your networking sites like facebook, YouTube, TeacherTube, etc.	

5. Sanctioned Races

To earn league points, teams organize and participate in sanctioned race events any time during the season (Oct – April). Sanctioned Races must include at least three events. See sections 5b on event options and corresponding points.

There are two types of sanctioned races. See the *FTRC STEM League Handbook* for details on each.

1. Face-2-Face: 2 or more teams from different organizations meet in one location
2. Web (Synchronous): 2 or more teams from different organizations compete from their own facilities while communicating via video conference such as Skype or Ten80's web portal.

To qualify for points, an event must have:

1. A minimum of two teams from at least two different schools with a minimum of two cars entered in any single class.
2. No more than 12 team entries;
3. At least one Sanctioning Official to inspect team cars and certify results at each location if teams are in more than one location. An adult team mentor can be a Sanctioning Official. See section 5a for more information.
4. A minimum of three race events

Teams must use official, registered FastTrack RC 1:10 Scale Cars with only the allowed modifications as outlined in section 6 on Cars. Register team cars using the *FTRC Team Registration Form* and is available for download from the Forms section of the FastTrack RC team web site.

12 Sanctioned Races in a calendar year is considered a "full season". If teams race in more than 12 events, the 12 best results will be counted. Teams can qualify for the Annual National Finals if they participate in a minimum of 4 events.

5a. Sanctioning Official

A local Sanctioning Official can be any adult who has registered with the FastTrack RC Sanctioning Body and who has agreed to abide by the official rules set forth in this document.

Sanctioning Officials are ultimately responsible for:

1. Coordinating the event
2. Enforcing rules set forth in this document
3. Reporting results using the forms from the FTRC Team Web Site or STEM League Handbook

To become a Sanctioning Official:

1. Complete and return the *FastTrack RC Team Registration Form* with your name as team coach.
2. Initial and date each page and sign at the end of this document. Return the initialed and signed document by email, fax or mail.

5b. Race Event Options

See details on how to organize, prepare for and run events in the *FTRC STEM League Handbook, Organizing & Running Sanctioned Races* section.

Minimum Number of Events: Sanctioned races must include at least three race (3) events.

Maximum Points: Scores for no more than four events will be awarded to participating teams. You can do as many events as you have time for, but only the top four (3 race events + 1 other) will count for national points. If one race event is eligible for 20% bonus points, the maximum competition score possible is 420 (1st place in all 4 events to give 100 + 100 + 100 + 120 points).

Event Options: At minimum, a Sanctioned Race is three race events. It can however include both race and non-race events. Event options are outlined in Tables 5b-1 and 5b-2 with additional details on the following pages. The Sanctioning Official shall announce the events, track and surface as far in advance of the event as possible. As many teams as possible should be involved in the decision so as to avoid the impression that one team has an advantage over others.

Table 5b-1: Race Event Options

Option	Name	Event Score	Bonus Points?	Option
1	Go Fast	Score = Lowest single lap time out of 4 laps Winner = Lowest Score	No	
2	Getting Up to Speed	Score = Total Elapsed Time over 5 Continuous Laps Winner = Lowest Score	No	
3	Up to Speed	Score = Total Elapsed Time over 10 Continuous Laps Winner = Lowest Score	No	
4	Faster, Further	Score = $(\text{Number of Laps})^2 \div (\text{Total Elapsed Time})$ <i>Drive up to 10 minutes, up to 3 cars on track at a time</i> Winner = Highest Score	Yes, 10%	Require a pit stop to change tires: remove tires, touch ground, re-install
5	Exponentially Faster & Further	Score = $(\text{Number of Laps})^A \times (\text{Total Elapsed Time})^B$ <i>Similar to faster, further except that exponents A and B are chosen at random within one week in advance of race day</i> Winner = Highest Score	Yes, 20%	
6	Pit Stop Drag Race	Score = Total Elapsed Time Winner = Lowest Score	No	
7	Aero Track	Score = Total Elapsed Time over 20 laps Winner = Lowest Score	No	

Table 5b-2: Optional Non-Race Options

An outside judge must be present that has no prior relationship with participating teams and has experience the appropriate field. These local events provide good feedback for your national entries.

Option	Name	Event Details
1	Team Presentation	8 minute presentation Teams and judge use the Team Presentation rubric provided
2	Car Body Decal Design	Teams and judge use the Car Body Decal evaluation criteria provided
3	Team Identity	Teams and judge use the Team Identity rubric provided
4	Business Plan	Submit a business plan document and give a 3 minute presentation. Judge should be someone from business and/or investment community.

Measuring Time: At least three people must measure drive times. The three times for each lap and/or trial are averaged unless one is obviously incorrect.

Penalties: Two (2) seconds is added to lap time each time a cone moves after being hit by the driver.

Event Points: After all teams have raced in an event, add penalties and calculate the Event Score. Rank teams 1st, 2nd and so on. Use Table 5c-1 to assign Event Points to each team. Section 5c gives more detail on how points are awarded.

Bonus Points: The more complicated events are worth bonus points to all participating teams. For example, if the event is worth 20% bonus, the 1st and 2nd place teams re awarded 120 and 108 points.

Track: All race events except the Pit Stop and Aero Track (Options #6 and #7) and are run on the competition track chosen from the 10 options provided. The Pit Stop is a 30 ft or longer drag strip with pit box. The Aero Track is a large, oval track that is at least 75 feet between turn points.

Event Option 1: Go Fast!

Event Score = Lowest Single Lap Time Including Penalties *Winner = Lowest Single Lap Time*

Teams are rewarded for engineering a fast, well balanced car and driving as fast as possible. Each team drives the course four (4) times from a standing start. Three people measure and record the drive time and penalties for each lap. At the end of four laps, add 2 seconds for every penalty then record the lowest resulting lap time as Event Score.

Event Option 2: Getting Up to Speed

Event Score = Total Elapsed Time Including Penalties Over 5 Continuous Laps

Winner = Lowest Elapsed Time

Teams are rewarded for driving fast over 5 continuous laps without stopping. At least two people measure and record total elapsed time. After 5 laps are completed, add 2 seconds for every penalty then record the resulting time as the Event Score.

Event Option 3: Up to Speed

Event Score = Total Elapsed Time Including Penalties Over 10 Continuous Laps

Winner = Lowest Elapsed Time

Time Saving Option: 2-3 cars on track at a time (do you have enough people to measure time?)

Teams are rewarded for driving fast over 10 continuous laps without stopping. At least two people measure and record total elapsed time as the Event Score. After 10 laps are completed, add 2 seconds for every penalty then record the resulting time as the Event Score.

Event Option 4: Faster, Further

Event Score = (Number of Laps)² ÷ (Total Elapsed Time Including Penalties)

Winner = Highest Score

Time Saving Option: 2-3 cars on track at a time (do you have enough people to measure time?)

All teams must have batteries with equal capacity and complete the final lap or the score goes to zero. There can be more than one driver, pit stops and/or multiple batteries installed. At least one person must measure time, count laps and penalties for every car on track. After event, add 2 seconds for every penalty to the total elapsed time then calculate the Event Score.

Event Option 5: Exponentially Faster, Further

Event Score = (Number of Laps)^A ÷ (Total Elapsed Time Including Penalties)^B

Winner = Highest Score

Time Saving Option: 2-3 cars on track at a time (do you have enough people to measure time?)

The exponents A and B will be defined randomly by participants and announced at least one day before the event. Use dice or some other method to choose from the possible scores outlined in your *FTRC STEM League Handbook*.

Teams must complete the final lap (cannot run out of energy or the score goes to zero). There can be more than one driver and pit stops are allowed. The best strategy will depend on the exponents. One person must measure time, count laps and penalties for every team on track. Event score is calculated from total elapsed time and number of laps.

Event Option 6: Pit Stop Drag Race

Event Score = Lowest Elapsed Time Including Penalties

Winner = Lowest Score

Teams drive a 30 foot-long or longer drag strip and into a pit box, a box outlined with tape on the ground. Team-members can only touch the car while it is in the box. Once in the box, team members must move the 2 front tires to the back and two back tires to the front. With tires re-installed and car inside the pit box, the driver drives the car back to the start-finish line.

At least two people measure total elapsed time and look for penalties. Timers should put marks on front tires so as to confirm they were switched once the race is over.

Optional variation: Give teams 5 minutes during which to try multiple times and record their best.

Event Option 7: Aero Design

Event 4 Score = (Number of Laps)² ÷ (Total Elapsed Time Including Penalties)

Winner = Highest Score

Time Saving Option: 2-3 cars on track at a time (do you have enough people to measure time?)

All teams must have batteries with equal capacity. This event is run on a large, oval track on which aerodynamic designs will win the day. Teams drive 20 continuous laps. With consistent driving, no acceleration is required so aerodynamic drag will be the biggest factor in determining the score. At least two people measure time, count laps and look for penalties. Event score is calculated from total elapsed time and number of laps.

5c. Race Events Points

Points are calculated and awarded as follows for each team:

1. Event Scores: Run the events, recording lap times or total elapsed time^A, penalties^B and if required, the number of laps. Calculate the Event Scores and rank teams 1st, 2nd, 3rd, etc. in each event.
2. Event Points: For each event, use *Placement Table 5b-2* to assign Event Points based on ranking.

Placement Table 5b-2: Event Points awarded in each race event and non-racing event.

Event Ranking	Event Points
1st Place	100
2nd Place	90
3rd	85
4th	80
5th	75
6th	70

Event Ranking	Event Points
7th	66
8th	62
9th	58
10th	54
11th	50
12th	47

3. Competition Score = (Event 1 Points) + (Event 2 Points) + (Event 3 Points) + (Event 4 Points)^C
4. FTRC National STEM League Points: Competition Score + Participation Points
where Participation Points = 5 x (Number of Teams Competing)

A. Timers: At least 3 people measure event times then average times.

B. Penalties: 2 seconds added to lap or elapsed time each time a cone is hit and moved

C. If you only had 3 events, Event 4 Points are zero for each team.

5d. Non-Race Events Judging Rubrics & Criteria

To judge non-race events in Sanctioned Races, use the following rubrics and criteria provided in the final section of this document or the league curriculum.

- Evaluation Rubric: Team Presentation
- Evaluation Criteria: Team Identity (Logo, Color Scheme, etc.)
- Evaluation Criteria: Car Body Decal Design
- For Business Plan, provide judges with a copy of the *Business Planning* curriculum section

6. Official Cars & Permitted Modifications

Permitted 1:10 scale, electric RC cars are supplied exclusively in FastTrack RC Kits by Ten80 Education or sanctioned partner suppliers. Sanctioned partners suppliers are listed on the Ten80 Education or FastTrack Challenges websites (www.Ten80Education.com or www.FastTrackRC.com).

Teams are invited to make changes to their car(s) within limits. For a visual explanation, see the presentation from the FTRC Team Web Site entitled, "What Can I Change on My Car". If it is not listed below as prohibited, teams can modify it.

PROHIBITED modifications are as follows. You CANNOT:

Motor: Install a motor with fewer than 15 turns or install more than one motor in a car.

Battery: Use any battery other than NiCd or NiMH, one with a voltage higher than 8.4V or capacity higher than 4200 mAh.

Electronic Controls: Change or modify the electronic controls. If controls must be replaced, teams must purchase replacements through Ten80 Education only.

Controller: Use a programmable controller; Your controller should cost less than \$80 retail.

Have Non-Team Members Design of Custom Parts: Designs for custom parts MUST be made by a FastTrack RC Team Member who is a K-12 student. The FastTrack RC Sanctioning Body has the right to request student designs for custom parts at any time.

Pay for Custom-Made Parts: Teams can partner with manufacturers and community organizations to fabricate parts that Team Members (K-12 student) design because negotiating partnerships is a valuable skill. Teams CANNOT however pay for any manufacturing or fabrication. Teams CAN pay for materials if labor and machine time is donated. The FastTrack RC Sanctioning Body has the right to request partner agreements for fabrication of custom parts at any time.

7. FTRC Annual National Finals

The FastTrack RC Annual National Finals (ANF) will be hosted in May of each typical K-12 school year (dates to be announced during the Fall semester). Teams that qualify through accumulating FTRC points will be invited in the month prior to the ANF. The FastTrack RC ANF is limited to 20 teams. The teams with the highest number of points from each region is assured an invitation to the FTRC ANF.

The remaining half of the starting positions will be awarded to the highest scoring teams in a series of "heat races" that will be held in the days prior to the ANF. The regional leaders are assured a starting place, but these Wild Car heats assure that any team can race their way into the FastTrack RC ANF. Because of these Wild Car rounds, any team that believes in its skill can race their way to the ANF. No team is precluded by a late start, short season, or poor performance in the early part of a season from being in the ANF.

Teams are responsible for securing their travel to the ANF host site. Teams are also responsible for their own lodging and other expenses while at the ANF though Ten80 Education and partners will seek sponsorship (there is NO guarantee of securing the financial aid). The FastTrack RC Sanctioning Body will secure discounted event prices for lodging during race week.

The formal Finals Event Guide will be available for download by December of each season. Prior year

FastTrack RC National Finals Events

#	Event	Description	Performance Guide	Possible Points	Scoring
	Three (3) Race Events	Challenge track announced 2 weeks in advance	Descriptions in Event Guide	100 each <i>300 total</i>	Race Event
	Endurance Race	Drive 50 laps - use any strategy that does not violate rules	First to cross line wins; pit stops allowed	100	Race Event
	Aerodynamic Design	Test car body design in a wind tunnel	Score rewards for high Lift:Drag ratio, low weight	100	
	P.I.T. NOW! Alternative Energy Project	Present your project to a judge. Challenge is to charge your car 'off the grid' or work on a similar development toward sustainable transportation systems	P.I.T. Now Evaluation Rubric	200	
	Creative Engineering Project	Develop something that is patentable and present your project to a judge	Creative Engineering Evaluation Rubric	200	
	Team Presentation	Present your team's business plan and summarize your work (8 min)	Team Presentation Evaluation Rubric	200	
	Car Body Decal Design	Begin with a 2-D design then install it on a real car body	Car Body Decal Design Evaluation Criteria	100	

**** Details are subject to change.**
Download the 2010-11 Finals Event Guide in December 2010 **
 For additional details, download the 2009-10 Finals Event Guide at FTRC team web site

Scoring: Race Event

Event Ranking	Event Points
1st Place	100
2nd Place	90
3rd	80
4th	70
5th	60

Event Ranking	Event Points
6th	50
7th	45
8th	40
9th	35
10th - 15th	30

Scoring: Project & PPT

Event Ranking	Event Points
1st Place	100
2nd Place	90
3rd	80
4th	70
5th	60
Participate	40

P.I.T. Now! Alternative Energy Project Description

Goal: To minimize the amount of energy used and CO₂ footprint created by the FastTrack RC National STEM League. It does not have to be used in any performance tests like the race events.

Example Topics: This category is similar to the Creative Engineering category but is limited to only projects focused on energy use. For example, the following are considered Alternative Energy projects:

- Charging batteries without using a wall plug; i.e. solar, wind, bio, natural gas, fuel cells, etc.
- Optimizing energy efficiency of the car through aerodynamics, reducing waste heat loss, etc.
- Optimizing energy efficiency of the FastTrack RC team (ex. quantifying energy use for a typical FastTrack RC competition and organizing a competition that cuts the use dramatically)

Project Communication: Shown like a 'science fair' project with visual and verbal presentations

1. Visual: In your pit area, display a visual 'table-top' or 'floor-stand' presentation (like science fairs) so that viewers can learn the project purpose, procedures, data, analysis, conclusions and suggestions for future work.
2. Verbal: A professional judge will come to your pit area where your team will verbally present the project. Your presentation should be under 5 minutes and will be followed by a Q&A session.

Required Presentation Content

- Clearly stated purpose including hypothesized benefits if implemented throughout the league
- Analysis of the sources of electricity for your electric grid (ex. 70% coal + 5% nuclear + 5% wind +.....)
- Explanation (visual and/or narrative) of how the energy source transforms to electricity
- Viability for scale-up to all FTRC teams or to full-scale human systems (cars, meetings, etc.)
- Economic pro's and con's of this project if implemented throughout the league
- Environmental pro's and con's of this project if implemented throughout the league including energy use, CO₂ footprint and other pollution (like particulate matter) created by the energy sources.
- Logbook including procedure, data and analysis (graphs)
- Conclusion and recommendations clearly based on data
- Information source citations

Technical Content: Breadth of the System

This project DOES NOT require a full life-cycle analysis, meaning you DO NOT have to evaluate the energy required and environmental impact of manufacturing the solar panels, wind turbines, generators, etc. used in your system. Your system only has to evaluate the energy requirements and CO₂ output of its operation.

Technical Content: Values & Methods to Employ

Because your numbers can vary depending on the source (for example, getting them from a coal company vs. anti-coal activist groups), use the following values in your analysis:

Energy to Charge a Battery:

$P = EI$ is a common equation for calculating power (P) from electrical current in amps (I) and potential energy in volts (E). As the Note on Energy & Units explains, energy used is the power sustained over time and the following calculation for your FastTrack RC system can be derived.

Theoretical Energy from Full Drain to Full Charge = Battery Capacity × Voltage

$$\text{Ex. Battery Capacity} = 3300 \text{ mAh} \div 1000 \text{ mAh/Ah} = 3.300 \text{ Ah}$$

$$\text{Ex. Theoretical Energy Use} = 3.300 \text{ Ah} \times 7.2 \text{ V} = 23.76 \text{ Wh}$$

In reality, batteries DO NOT go to full drain. Empirical testing shows that about 30% of the battery capacity is used in any given cycle.

$$\text{Ex. Real Energy Use} = 3300 \text{ mAh} \times 7.2 \text{ V} \times 0.30 = 7.1 \text{ Wh}$$

Coal Power: More than 75% of the U.S. grid electricity is produced by coal or natural gas fired plants. You must find out the sources for energy delivered to your school and most likely it will be a combination of types. Below are the values to use for that portion that's provided by coal plants.

- A typical coal fired power plant uses 10,000 BTU to put 1 kWhr on the grid; that is a 34% conversion of chemical energy in the coal to electrical energy in the grid.
- Combustion of 1 pound of commercial coal provides 12,000 BTU and produces 3.4 lbs of CO₂.

Relationship between CO₂ & Energy Use: If your energy source is 'off-the-grid' like wind or solar, the CO₂ footprint is reduced linearly with the reduction in energy saved. If your source generates CO₂ in its operation, you must consider that in your analysis of savings.

CO₂ per Ton-Mile: To compare transportation systems, the amount of CO₂ per ton-mile of movement is a standard measure. It is a more accurate measurement for impact than just miles driven because a bus carries more payload than a car does over one mile and that should be considered.

Example Spreadsheet Calculation

	A	B	C	D	E	F	G	H	I
	milli-Amp-hr (mAh) per Amp-hr(Ah)			1000		CO2 produced by 1 lb coal:			3.4
	Actual Battery Capacity Used:			30%		FastTrack RC Car Weighs (lb):			4
	BTU Produced per KWh Grid Energy:			10,000		FastTrack RC Car mileage (miles/charge):			0.8
	Coal Produces, BTU per pound:			12,000		pounds (lb) per ton			2,000
		Battery Capacity	Battery Voltage	Theoretical Energy Used	Actual Energy Used	Energy Production Required	Coal Required	CO2 Produced	CO2 per ton-mile for FTRC car
	Units	mAh	V	Wh	Wh	BTU	lb	lb	lb per ton-mile

Creative Engineering Project Description

Goal: To develop a product or process that could warrant a patent submission under the United States Patent and Trademark Office. The underlying criterion for a unique submission is that it is "an idea that is not obvious to a person reasonably skilled in the art." The product or process does not have to be included in any performance tests or race events.

This project was implemented for 2010 because teams were doing very innovative things through which the team was learning a lot; however there is not always a direct positive impact on performance. This competition category is the venue to show off your ideas and project skills including good investigation planning, documentation, implementation, analysis and communication.

Example Topics: Any project outlined in the FastTrack RC projects listed under the Mechanical Engineering Projects booklet. Strictly following these guidelines will qualify your team for full scores in every criterion except creativity (see the evaluation rubric).

Project Communication: Shown like a 'science fair' project with visual and verbal presentations

1. Visual: In your pit area, display a visual 'table-top' or 'floor-stand' presentation (like science fairs) so that viewers can learn the project purpose, procedures, data, analysis, conclusions and suggestions for future work.
2. Verbal: A professional judge will come to your pit area where your team will verbally present the project. Your presentation should be under 5 minutes and will be followed by a Q&A session.

Required Presentation Content

- Clearly stated purpose
- Viability for scale-up to all FTRC teams or to full-scale human systems (cars, meetings, etc.)
- Economic pro's and con's of this project
- Impact on performance of the car in various types of races; use data to back up your conclusions
- Logbook including procedure, data and analysis (graphs)
- Conclusion and recommendations clearly based on data
- Information source citations
- It is not required, but teams that use SolidWorks 3-D CAD to analyze and plan their project will earn points in the 3-D CAD criterion (see the evaluation rubric).

Team Presentation Description

Goal: Through the team presentation you will showcase your communication skills by conveying to the FTRC panel what your team has been doing and how you did it. Your team can provide print materials to the judges' panel that would help 'drive home' your message. For example, handout your team business plan document or public relations materials.

Presentation Format:

- Duration: 8 minutes; do not go over time and target to finish as close to 8 minutes as possible.
- Electronic Files: Files must be in one of the following common formats:
 - A. PowerPoint or Keynote
 - B. Adobe Acrobat Reader (PDF)
 - C. Adobe Flash or Java Applets
 - D. Common image files (JPG, BMP, TIF, etc.)
 - E. Common movie files (mp4, wmv, mp3, mov, etc.)
- Paper Handouts: If you choose to handout materials to the judges, provide 3 copies.
- Presentation Equipment: There will be a computer, DLP projector and speakers for your use.
- Registration: Electronic files must be submitted to Ten80 during set-up before competitions begin. You will fill out an envelope into which your jump drive will be stored until it is time for your presentation.

Project Communication.

The main story you are telling is up to you. It can be like a business plan presentation to potential sponsors or as a summary report to a current sponsor or 'boss' showing them the return on investment (ROI) in your team was high.

Within your chosen format, the following topics must be addressed.

1. Main team goals
2. Team management and structure
3. How your team is organized; what are the main jobs and how do they work together?
4. 'Round estimate' of the budget for your team and how you acquired the funding
5. Public Relations activities including logo development, public relations and sponsorship seeking
6. Race engineering strategies, activities and efforts to optimize their racing performance and overall energy efficiency.
7. Outline of any projects your team implemented
8. Other types of learning; what did students gain from the FastTrack RC this year?
9. What are the plans to improve in the future?

8. Evaluation Rubrics & Criteria

Race events are scored according to the race event descriptions. Non-race events are evaluated as outlined in this section. Rubrics are subject to change prior to the FTRC Annual National Finals. Download the latest versions by January 2011.

Rubrics and Criteria include:

- Evaluation Criteria in this section: Team Identity
- Evaluation Criteria in this section: Car Body Decal Design
- Evaluation Rubric in this section: Team Presentation
- Evaluation Rubric in this section: P.I.T. Now Project
- Evaluation Rubric in this section: Creative Engineering Project
- Wind Tunnel Test & Evaluation Rubric to download in Jan 2011: For Aerodynamic Design of a 1:10 car body, see the Aerodynamic Design booklet. Bodies will be tested in a 1:10 scale wind tunnel and evaluated based on Lift:Drag Ratio, weight, creativity and fabrication quality.

Evaluation Criteria: Team Identity (Logo, Color Scheme, etc.)

For each entry, judges rate the entry 1 - 4 for each criteria. Add the points to get the Event Score.

1. **CONTENT:** Is the submission a team logo only or is it a full team identity including logo, color scheme, merchandise examples and potentially guidelines on how to use the logo?
2. **CONCEPT:** Technical or artistic skills are not considered, but creativity and 'cleverness' are.
3. **TECHNICAL:** How well is the concept implemented by hand or design software?
4. **MERCHANDISING/BRANDING VALUE:** Does the identity work well on T-shirts, signs, as a car decal? Does it grab your attention from afar? Is it memorable and does it bring to mind your project?

Evaluation Criteria: Car Body Decal Design

For each entry, judges rate the entry 1 - 4 for each criteria. Add the points to get the Event Score.

1. **SPONSOR MARKETING:** How well are the team and league sponsor logos displayed? Can you see them from afar? How many are included?
2. **CONCEPT:** Technical or artistic skills are not considered, but creativity and 'vision' are. The 2-D drawing is considered heavily.
3. **TECHNICAL:** How well is the vision implemented on the 2-D design and actual car body?
4. **2-D to 3-D:** How close is the plan to the final product? If there are changes, are the reasons well documented?

Evaluation Rubric: Team Presentation

Criteria	Novice 1 point	Apprentice 2 point	Practitioner 3 point	Expert 4 point
Audience Response & Eye-Contact	<ul style="list-style-type: none"> Incoherent; audience lost interest. Reads all or most of report with no eye contact. 	<ul style="list-style-type: none"> Some related facts but went off topic and lost the audience. Some eye contact but not maintained and at least half the time; reads most of report. 	<ul style="list-style-type: none"> Presented facts with some interesting "twists"; held the audience attention most of the time. Mostly maintains eye contact but frequently returns to notes. 	<ul style="list-style-type: none"> Involved the audience in the presentation; held the audience's attention throughout. Maintains eye contact seldom note use; like a planned conversation.
Organization & Logic	<ul style="list-style-type: none"> Poor organization. Does not clearly introduce the purpose Choppy and disjointed because there is no apparent logical order of presentation Ends without a summary or conclusion 	<ul style="list-style-type: none"> Somewhat organized. Introduces the purpose Jumps around topics. Several points are confusing Ends with a summary or conclusion that seems disconnected to content 	<ul style="list-style-type: none"> Generally well organized Introduces the purpose clearly. Most information is in logical sequence; A few minor points may be confusing Ends with a summary of main points 	<ul style="list-style-type: none"> Extremely well organized Introduces the purpose clearly and creatively Presents information in logical, interesting sequence which audience can follow Ends with a strong conclusion
Creativity	Bland, predictable, and lacked "zip. Repetitive with little or no variety; little creative energy used	Little or no variation; a few original touches but for mainly presented with little originality or interpretation	Some originality apparent; clever at times; good variety and blending of materials/media	Very original, clever, and creative approach that captures audience's attention
Use of Communication Aides	Uses superfluous graphics, no graphics, or graphics that are so poorly prepared that they detract from the presentation Font is too small to be easily seen	Occasional use of graphics that rarely support presentation content; visual aids were not colorful or clear, choppy, time wasting use of multimedia Font is too small to be easily seen	Graphics aid thesis but media should be more varied and connected to presentation content. Font size is appropriate for reading	Graphics reinforce content and aid audience understanding; use of media is varied and not added simply for the sake of use. Visuals colorful and large enough to be seen by all
Content: Team Organization, Funding	Little of these topics were covered. Audience had little feel for the team's organization and funding.	Not all content was covered or was covered so audience had a grasp of organization and funding	For the most part, the content was covered.	Speakers give a good picture of the team's organization and funding.
Content: Race Engineering & Projects	Little of these topics were covered. Audience had little feel for the team's technical investigations and projects.	Not all content was covered or was covered so that audience had a grasp of team's technical investigations and projects.	For the most part, the content was covered.	Speakers give a good picture of the team's technical investigations and projects..

Evaluation Rubric: P.I.T. Now Alternative Energy Project

Criteria	Novice 1 point	Apprentice 2 point	Practitioner 3 point	Expert 4 point
Goals, Purpose and Innovation	The explanation isn't clear at all and/or doesn't relate to minimizing or reducing energy use and environmental impact of the FTRC league.	A short explanation is given but the mission isn't clearly conveyed and questions of its relevance remain or the proposal is already common place.	A thorough description is given and is innovative; however, it only marginally relates to minimizing or reducing energy use and environmental impact of the FTRC league.	A thorough description is given, the project is innovative and directly relates to minimizing or reducing energy use and environmental impact of the FTRC league.
Actual	Ideas only are given with no detail on how it would actually be implemented for a team or the league.	A simple description of how the project would be implemented is given but there are unanswered questions; did not consider relevant obstacles.	A description of how the project would be implemented is given with some data to back it up; however, the audience isn't convinced it is viable.	A thorough description of how the project would be implemented is given with real, accurate data to back it up. The audience is convinced it is viable.
Economic Impact	There is no discussion of the economic impact of the implementation.	Impact is reported, but references to data are infrequent, inaccurate or inappropriate	Impact is clearly reported and supported by data that was collected, evaluated and presented clearly.	...And the impact is significant.
	There is no discussion of the actual impact on energy and CO2 from of the implementation	Impact is reported, but references to data are infrequent, inaccurate or inappropriate	Impact is clearly reported and supported by data that was collected, evaluated and presented clearly.	...And the impact is significant.
Data Organization	<ul style="list-style-type: none"> • Data are inaccurate • Data are haphazardly recorded • Data tables missing 	<ul style="list-style-type: none"> • Most data are collected but checks are not placed on measurement to insure accuracy • Data recorded in a manner that threatens reliability • Data tables incomplete or contain inconsistencies 	<ul style="list-style-type: none"> • All significant data measured with some checks placed on measurement for accuracy • Data recorded effectively • The data tables are relevant to the project requirements 	<ul style="list-style-type: none"> • All significant data measured, checks are placed on measurements for accuracy • Data recorded effectively and efficiently • The data tables well designed to the project requirements
Procedure &	Purpose, materials and procedures are not documented for all or most investigations. Reader cannot follow what was done.	Purpose, materials and procedures are documented before most but not all investigations. Reader has to infer what was done.	Purpose, materials and procedures are documented before each investigation but not completely clear. Reader has to infer some of	Purpose, materials and procedures are neatly documented before each investigation or analysis. Reader does not have to infer what was done.
Visual Presentation	Project has limited eye appeal or is not easily readable at 2 feet distance. The project has limited organization, or contains confusing visuals, or contains major language or spelling errors.	Project is appealing and readable at 2 feet distance. It is organized and clear, uses understandable visuals and/or models, and contains few language and spelling errors.	Project is appealing and neat, and is readable at 2 feet distance. It is well organized and clear, makes striking use of inventive or amusing visuals and/or models, and uses language and spelling flawlessly. Also presents a compelling argument with data to support the process, conclusions and recommendations.

Evaluation Rubric: Creative Engineering

Criteria	Novice 1 point	Apprentice 2 point	Practitioner 3 point	Expert 4 point
Goals, Purpose	The purpose of this project and what teams stand to gain from it isn't clear at all.	A short explanation is given but the potential gain from isn't clearly conveyed.	A thorough description is given about why the team is implementing this project.	...and its purpose is clearly beneficial to the team and potentially the league.
Patentable	Project is obvious to most observers and is not patentable.	Project is obvious to those skilled in the art and is likely not patentable.	Project idea is not obvious to those skilled in the art and could be submitted for patent with confidence. and support data is of high quality that the project seems highly patentable.
Actual Implementation (Viability) for FTRC Teams	Ideas only are given with no detail on how it would actually be implemented for a team or the league.	A simple description of how the project would be implemented is given but there are unanswered questions; did not consider relevant obstacles.	A description of how the project would be implemented is given with some data to back it up; however, the audience isn't convinced it is viable.	A thorough description of how the project would be implemented is given with real, accurate data to back it up. The audience is convinced it is viable.
Economic Impact	There is no discussion of the economic impact of the implementation.	Impact is reported, but references to data are infrequent, inaccurate or inappropriate	Impact is clearly reported and supported by data that was collected, evaluated and presented clearly.	...And the impact is significant.
Performance Impact	There is no discussion of the actual impact on race performance.	Impact is reported but data references are infrequent, inaccurate or inappropriate	Impact is clearly reported and supported by data that was collected, evaluated and presented clearly.	...And the impact is significant.
Data Organization	<ul style="list-style-type: none"> • Data are inaccurate • Data are haphazardly recorded • Data tables missing 	<ul style="list-style-type: none"> • Most data are collected but checks are not placed on measurement to insure accuracy • Data recorded in a way that threatens reliability • Data tables incomplete or contain inconsistencies 	<ul style="list-style-type: none"> • All significant data measured with some checks placed on measurement for accuracy • Data recorded effectively • The data tables are relevant to the project requirements 	<ul style="list-style-type: none"> • All significant data measured, checks are placed on measurements for accuracy • Data recorded effectively and efficiently • The data tables well designed to the project
Procedure & Documentation	Purpose, materials and procedures are not documented for all or most investigations. Reader cannot follow what was done.	Purpose, materials and procedures are documented before most but not all investigations. Reader has to infer what was done.	Purpose, materials and procedures are documented before each investigation but not completely clear. Reader has to infer some of what was done	Purpose, materials and procedures are neatly documented before each investigation or analysis. Reader does not have to infer what was done.
Visual Presentation	Project has limited eye appeal or is not easily readable at 2 feet. It has limited organization or contains confusing visuals, or contains major language or spelling errors.	Project is appealing and readable at 2 feet distance. It is organized and clear, uses understandable visuals and/or models, and contains few language and spelling errors.	Project is appealing and neat, and is readable at 2 feet. It is well organized and clear, makes striking use of inventive or amusing visuals and/or models. Language use & spelling are flawless. Also presents a compelling argument with data to support the process, conclusions and recommendations.
Verbal Presentation	Presentation is disorganized and does not discuss content requirements. Articulation is unclear. Presenters do not speak directly to audience.	Presentation is organized but doesn't discuss all content accurately. Eye contact pretty good; articulation is pretty clear	Presentation is organized and creative and addresses procedures and data accurately. Articulation is clear and eye contact good. Also presents a compelling argument with data to support the process, conclusions and recommendations.



Documents in this section are liable to change. Download the final documents for your year from the FTRC Team Site.

To make a team project plan, planners should read and understand this section. The points a team CAN earn should dictate who is on board and what they spend their time doing.

The types of points teams can earn are outlined in the Points System. When those points are awarded is outlined in the Points Schedule. For example, points are awarded for your race engineering investigations, marketing your team, managing your team and of course for participating and placing in competitions.

Teams claim points by submitting points forms in the next section. Electronic versions are available at the FTRC Team Web Site. The Race Results form is available as a spreadsheet for direct data entry.

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3. Race Engineering.....	2
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5. Project Management.....	3
6. Team Identity.....	3
7. Public Relations.....	3
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FTRC National STEM League Points System 2010-11

1. Sanctioned Races

Type	Points Award
Local, Face-2-Face Events	< 430
Web Races (Synchronous)	< 430

See details for how to run race events and award points in the *FTRC Rules & Guidelines* and in the *Running Sanctioned Races* section.

2. Monthly Challenges

Description & Criteria	Points
Details of the challenge are released via email and posted on the team web site montly or more frequently. The challenge may be a race event to be run independently as a team or it may be a project or investigation.	Varies, 100 - 500

3. Race Engineering

Teams are awarded points for completing each investigation and project in the formal FastTrack RC curriculum. After completing Chassis Set-Up Investigations, SolidWorks tutorials, Aerodynamics, Mechanical Engineering and P.I.T. Now projects, submit your data or products and the Race Engineering points form to claim your points.

Form	Description & Criteria	Points
<i>Chassis Setup Investigations</i>	Complete any of the formal investigations in the Chassis Setup Investigations Booklet then submit your data set and points form.	100
<i>SolidWorks Tutorial Design</i>	Install SolidWorks and take the tutorial(s). Submit your first complete SolidWorks design for points (designs will vary).	100
<i>Aerodynamics Design Projects</i>	Complete any of the projects in the Aerodynamics Design Booklet then submit images of your product, data and points form.	200-400
<i>Mechanical Design Projects</i>	Complete any of the formal projects in the Mechanical Engineering & Fabrication Book then submit images of your product, data and points form.	200-400
<i>P.I.T. Now Projects on Alt. Energy</i>	Complete any of the alternative energy projects in the P.I.T. Now (Petroleum Independent Transportation) book then submit images, data and points form..	200-400

4. Business Planning

Teams are awarded points for creating a business plan document and 3-8 minute presentation. The *Business Planning, Project Planning & Public Relations* booklet discusses how to make a business plan and provides some sample excerpts. The presentation is a 30-second elevator pitch and visual presentation of the executive summary. Submit the "Business Planning" points form with your pack to claim points.

Description & Criteria	Points
Use the <i>Business Planning, Project Planning & Public Relations</i> Booklet as a guideline for making your team plan. Once completed, submit your plan and the form for points. A complete plan must include: <ul style="list-style-type: none"> • documented plan • visual presentation file (PowerPoint, KeyNote, etc.) Extra points awarded based on quality: <ul style="list-style-type: none"> • flow of concepts and 'story' of your team; a compelling case • clear statement of team needs and budget • clear statement of how your community can support your efforts • high quality presentation file • optional but suggested - video of your giving your presentation 	400 -500

5. Project Planning

Teams are awarded points for creating their own team goal-based plan. The *Business Planning, Project Planning & Public Relations* booklet provides guidance and samples. Use a spreadsheet, word processor, project management software or other formats. Submit the "Project Management" points form with your plan to claim points.

Description & Criteria	Points
Use the <i>Business Planning, Project Planning & Public Relations</i> Booklet as a guideline for making your team plan. Once completed, submit your plan and the form for points. A complete plan must be: <ul style="list-style-type: none"> • based on stated goals that include measurable outcomes and dates • realistic (ex: if meeting once weekly, don't assign 40 hours of work to team members each week) Extra points awarded based on quality: <ul style="list-style-type: none"> • organization; individual tasks outlined in sensible order, • appropriate milestones are stated (special dates like completing the web or a competition). • format and its content are easily modified • stated assumptions and useful notes 	200 - 400 50 - 100 sub-team plans like Aero design

6. Team Identity

Description & Criteria	Points
Teams earn points for generating a team identity which includes a logo, color scheme and additional guidance on how the logo can be used. Use Adobe Illustrator or free design programs available for download from the web*. Designs are due April 1st of each year. Points are awarded for submitting an entry and for the top 4 teams (1st place gets 45 + 100 for winning = 145 points). Points will be awarded using the Team Identity evaluation rubric provided in the <i>Curriculum & Fundamentals</i> booklet and in the <i>FTRC Rules & Guidelines</i> .	Varies, 200 - 400

7. Public Relations

Teams are awarded points for creating a public relations strategy, plan and support materials. See the *Business Planning, Project Planning & Public Relations* booklet for guidance. Submit "Public Relations" form with your products to claim points.

Form	Description & Criteria	Points
<i>Public Relations Strategy & Plan</i>	Once completed, submit your strategy and plan documents plus the form for points. Extra points awarded based on quality: organization, stated assumptions and useful notes, useful for actual implementation and presentation to potential sponsors	100 - 200
<i>Public Relations Materials</i>	Design a team flier, business card and other similar items to let people know what your team is about.	50 - 200

8. Web & Networking Sites

Teams earn points for developing a team web site and and popular networking sites that are well connected to commercial and other approved organizations. Pre-approved networking sites include MySpace, Facebook, YouTube and Twitter. Other networking sites and linked organizations are subject to approval by the FTRC sanctioning body. Networking sites must be built from scratch and cannot be embedded in an existing site. Points are awarded for new links each year.

Form	Type	Examples	Award Points
<i>Web Site</i>	Team Web Site	Build a web site or web page within an existing site.	200 - 400
<i>Networking Sites</i>	Commercial Links	Ex. Hobby Town or HPI Racing link to your site	40 / link
	Other Organizational Links	Ex. National Science Teachers Association site or ACTE blog links to your site.	40 / link
	Networking Favorites	Your networking site is favorited by another user.	2 points / 10 favorites
	Normalizing Points	Your team receives points for growth only achieved in the current season.	Normalized

9. Media Exposure

Teams earn points for getting local, regional or national exposure for themselves and their sponsors with professional and non-professional media outlets as defined below. Press is eligible for points beginning in June of each year for the following school year. All press submitted is subject to approval by the FastTrack RC sanctioning body. Claim points by submitting evidence of coverage and the "Media Points" points form.

Professional Media

Type	Examples	Award Points
Print & Web	Professional magazines, newspapers, web articles	20 points / 100 words
Reprints	Iterations of the original article found in circulation at distinct media outlets	10 points / 100 words
Video	Professional TV Newscasts, Webcasts	100 points / 30 seconds
Audio	Team is mentioned on the professional radio or podcast	50 points / 30 seconds
Blog Mention	Team is mentioned on the professional blog	30 points / entry
Pictures, Standalone	Image in print or web without accompanying copy	30 points / iteration

Non-Professional Media

Outlets are associated with the team, team members, family members, school district, school or community organization

Type	Examples	Award Points
Internal Article	You post a press release on a school site or newsletter, print or web	10 points / 100 words
Video	TV, Newscasts, Webcasts	50 points / 30 seconds
Audio	Team is mentioned on the radio or podcast	25 points / 30 seconds
Blog Mention	Team is mentioned on the professional blog	15 points / entry
Pictures, Standalone	Image in print or web without accompanying copy	15 points / iteration

10. Car Decal Design

Teams earn points for generating a decal (or paint job) design for the stock RC car body. Use Adobe Illustrator or free design programs available for download from the web*. Designs are due April 1st of each year. Points are awarded for submitting an entry and for the top 4 teams (1st place gets 45 + 100 for winning = 145 points).

Award	Award Points
Submitted an Entry	100
Honorable Mention	+ 25

Award	Award Points
3rd Place	+ 50
2nd Place	+ 75
1st Place	+ 100

*Check with your own network coordinator before downloading anything from the internet.

Scoring Sanctioned Races

Details of events are listed in the *FTRC Rules & Guidelines* with data sheets available for download at the team web site. Sanctioned Races can be Face-2-Face or over the internet. See guidelines on how to organize both types in the section, *Organizing & Running Races*.

Minimum Number of Events: Sanctioned races must include at least three race (3) events.

Maximum Points: Scores for no more than four events will be awarded to participating teams. You can do as many events as you have time for, but only the top four (3 race events + 1 other) will count for national points. If one race event is eligible for 20% bonus points, the maximum competition score possible is 420 (1st place in all 4 events to give 100 + 100 + 100 + 120 points).

Event Options: At minimum, a Sanctioned Race is three race events. It can however include both race and non-race events. Event options are outlined in the *FTRC Rules & Guidelines*.

Race Events

- Go Fast
- Getting Up to Speed
- Up to Speed
- Faster, Further
- Exponentially Faster, Further
- Pit Stop Drag Race
- Aero Track

Non-Race Events

- Team Presentation
- Car Body Decal Design
- Team Identity (logo, color scheme, etc.)
- Business Plan

Points are calculated and awarded as follows for each team:

1. Event Scores: Run the events, recording lap times or total elapsed time^A, penalties^B and if required, the number of laps. Calculate the Event Scores and rank teams 1st, 2nd, 3rd, etc. in each event.
2. Event Points: For each event, use *Placement Table* to assign Event Points based on ranking.

Placement Table: Event Points awarded in each race event and non-racing event.

Event Ranking	Event Points
1st Place	100
2nd Place	90
3rd	85
4th	80
5th	75
6th	70

Event Ranking	Event Points
7th	66
8th	62
9th	58
10th	54
11th	50
12th	47

3. Competition Score = (Event 1 Points) + (Event 2 Points) + (Event 3 Points) + (Event 4 Points)^C
4. FTRC National STEM League Points: Competition Score + Participation Points
 where Participation Points = 5 x (Number of Teams Competing)

A. Timers: At least 3 people measure event times then average times.

B. Penalties: 2 seconds added to lap or elapsed time each time a cone is hit and moved

C. If you only had 3 events, Event 4 Points are zero for each team.

Organizing & Running Sanctioned Races

Sanctioned Races include at least 3 Race Events.

Participating teams earn National STEM League points for up to 4 events.

The Sanctioning Official defines the 3-4 events that count but teams can compete in as many as they choose to gain valuable practice and feedback.

A professional individual with experience in the field and no relationship with teams must be present to judge non-race events.

Race Events

- Go Fast
- Getting Up to Speed
- Up to Speed
- Faster, Further
- Exponentially Faster, Further
- Pit Stop Drag Race
- Aero Track

Non-Race Events

- Team Presentation
- Car Body Decal Design
- Team Identity
- Business Plan

See Rules & Guidelines for more details and this section for operational guidance.

This section provides guidelines and documents to help you organize, prepare for and run a sanctioned FastTrack RC race event.

See the Rules & Guidelines for more details on choosing race events and how to score them.



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Organizing, Preparing & Running a Race

There are additional things you have to do to prepare for a web-based race. Those are outlined under *Web Race Logistics* in this section.

Organize a Race

Announce an event through the FTRC Forum on the FastTrack RC Team Web Site. Distribute information about the event including the following. An example is provided in this section.



- Date and time
- Address and directions
- Name of the Sanctioning Official
- Race and (optional) Non-Race Events (See *FTRC Rules & Guidelines* for details)
- Track layout from options 1 – 10 in the Challenge Track & Scores section.
- Track surface like basketball court, asphalt parking lot, etc.
- If running the Exponential Faster, Further race event, exponents A and B
(See *FTRC Rules & Guidelines* or *Challenge Tracks and Scores* section for details)

Prepare for a Race

At the least, you should do the following in preparation for the event. Example schedules and data sheets are provided in this section.

- Seek volunteers and sponsors for food, prizes, transportation, etc.
(*example form in this section*)
- Confirm participants as race day nears
- Layout the track & gather stopwatches
- Prepare platform for drivers to stand on (bed of a pick-up truck, stage, raised platform, etc).
- Prepare (1) track schedule and (2) Race Score Sheet and share with all teams
(*paper version in this section; customizable spreadsheet available for download from FTRC Team Web Site*).

Run and Report a Race

At the least, you should do the following when running and reporting the event.

- Assign roles including: Timer 1, Timer 2, Timer 3, Recorder, Line Referee
- Inspect cars and record compliance with *FTRC Rules & Guidelines* on Race Results Form.
- Run the Race according to the *FTRC Rules & Guidelines*.
- Have all teams sign-off on results that will be reported.
- Submit Race Results Form and Race Score Sheet
(*via e-form at the FTRC Team Web Site, fax, email or mail*)

Web Race Logistics

Follow the general guidelines under *Organizing, Preparing for and Running a Race* in this section. Here are additional requirements when you're setting up remote communication.

Tracks and other variables are not the same when competing over the web. Teams have to deal with it or don't do it! When competing in different places and under different conditions, the score will not as accurately define performance as it does in face-to-face competitions but that is part of your challenge. You set up for your conditions. Teams are on the honor system regarding measured drive times and track dimensions. The reality is this: teams simply have to agree ahead of time on the rules and agree to abide by final scores.



Organizing a Web Link

Many schools are equipped with video conference technologies. Check with your technology administrator to see what's available and if it's compatible with other teams. Below are free programs you can download and install with permission and assistance from your technology administrator:

- Skype (<http://www.skype.com/>): Use Skype if only two teams need to communicate via the web.
- TokBox (<http://www.tokbox.com/>): Use TokBox if more than two teams are competing. Many schools are using TokBox as a district-wide communication tool between administrators and teachers.

If you are not able or allowed to use these programs, contact someone from Ten80 to ask about using Ten80's video portal. There are a lot of things you can share through this portal

It is critical that you test the connection to ensure it isn't blocked by a firewall.

To compete over the internet, you must have the following available at the competition site:

1. Computer with Internet connection (can be a wireless card and phone service)
2. Web cam
3. Audio Headset for computer

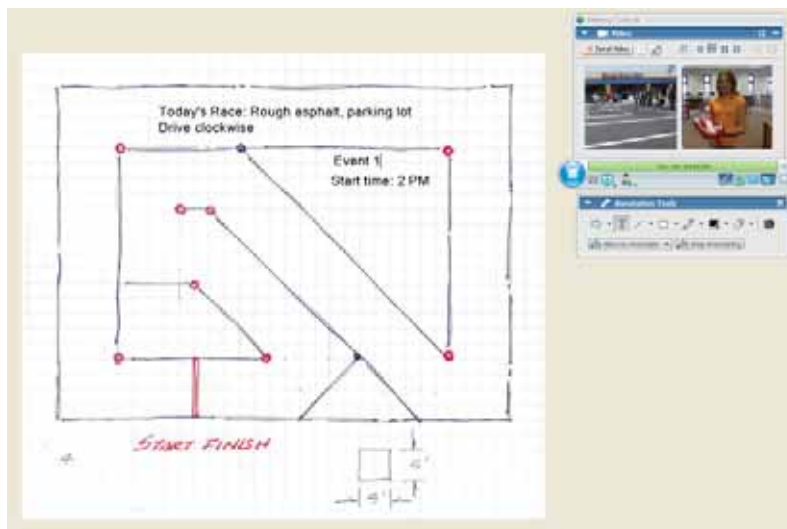
Preparing for a Web Race

To prepare for the remote race, do the following:

1. Confirm the internet connection works and is available at the requested time
2. Test the web connection between teams. If through Ten80, arrange a test time with Ten80.
3. Layout the track. Take a picture of the track with some reference showing a standard measurement (meter stick). Share pictures among participating teams so that every team agrees the tracks are laid-out correctly.
4. All teams agree that track surfaces are comparable. You can (but don't have to) define the traction by finding the coefficient of friction between the surface and stock tires. Consult the *Chassis Setup Investigation* Booklet for directions on how to run a skid pad test.

Running a Web Race

Refer to Run & Report a Race under *Organizing, Preparing for and Running a Race* in this section for running the race. Below are guidelines only to help with the web component of your race.



1. Login and agree on camera placement and order in which teams will race and stream video. Ideally, teams take turns so that only one team is racing at any time. The racing team broadcasts video while driving.

If time is limited and/or there are a large number of teams competing, you can agree which teams drive at any given time and which team is broadcasting. Each team should make sure to observe the other team's performance.

A sample team driving schedule is given after the team data sheet in this document.

2. Using the video stream, teams show the car or cars they're racing. The Sanctioning Official records the car number, team names and number of participants per team.

The Sanctioning Official and any team coach can ask to see a team's car at any time during the competition. When that request is made, the team holds the car up to the video and answers any relevant questions about how the race is being performed (You do NOT have to give away trade secrets or talk about your car set up and strategy, only logistics on how this race is run or scored).

3. Race as agreed with . Both teams keeping track of the scores using a race score sheet (PDF and spreadsheet versions available for download at the FTRC team web site for all events).

After each event, teams share scores and agree that the event was run fairly and scores are official. Teams must state any objections they have before the next event begins. As in football, once the next 'play' has begun you cannot raise objections.

4. Sanctioning Official asks each team to verbally sign off on the race results then submits the *Race Results Form* and data sheet through e-form at the FTRC Team Web Site, fax, email or mail.

Monthly Challenge - Video Races

Sometimes, the monthly challenge is a video race. A track, event and score are announced via email and posted at the FTRC team web site. These monthly challenges are considered asynchronous because teams can complete them anytime between announcement and deadline which is usually 2 - 3 weeks.

Teams set up the track at their facility and run it at any time. They document the race by filming it, editing the footage and uploading the video in one of the formats listed below.



Site	How	Size Limits
FTRC Team Site Upload	Zip in Points Reporting Section	50 MB
Facebook	Become a Fan of Ten80, upload as a fan	100 MB, 2 min
Facebook	On your own FTRC Team page	100 MB
TeacherTube	Friend Ten80, upload to your own FTRC site	100 MB
YouTube	Follow Ten80, upload to your own FTRC team site	2 GB

An example monthly challenge announcement is shown below.

Monthly Challenge: FTRC Video Race
Begin Date - Deadline

Competition Track: FTRC Track #

Points: 100

Video Upload and Points Forms Due: *Deadline Date* at 11:59 PM

Reference: Track # diagram and Track Layout Lesson

Documentation Required: Race Data Sheet, Results Form & Video

- Submit Race Results: Fill in the competition data sheet during the event. Report points and submit the data sheet using the e-form in web section #11.
- Submit Video: Digitally film the three events, edit them to the size limits and upload to one of the approved sites. Each of the three events must be represented in the video with proper captions to let viewers know what they're seeing.

Example Race Announcement

FastTrack RC

This announcement was circulated to the teams of Charlotte, NC and Columbia, SC.



2nd Annual Mallard Creek FTRC Invitational

Sanctioning Official: Mallard Creek High School *[Name & email removed]*

Date: *[Date Removed]*

Time: 9:00 a.m. to 2:00 p.m.

Location: Parking lot of Hobby Town

Meet information:

- Please RSVP by Friday 01/29/2010 with the number of teams and students that plan on attending.
- There will be various vendors on display during the event for your students to check out. For example: ITT Tech, National Guard, etc....
- The meet will be held in the parking lot of Hobby Town. The surface will be rough asphalt.
- The scoring and Events will follow the Standard Class in the FTRC STEM League Handbook
- Track is #4 in your FTRC Handbook, Challenge Tracks & Pro Scores section.
- We will be using the FTRC Competition Team Data Sheet to score the events.
- Please refer to your team manual for rules and regulations for the meet and car specifications. If there are any questions please contact an FTRC official.
- Each team will have a limited amount of practice time prior to the events start.
- If there is a chance for rain we will relocate the meet to Mallard Creek High School. Everyone will be notified by the Weds prior to the meet.

Event #1 Go Fast!

Winner = Lowest single lap time out of 4 laps (called the bracket lap time).

Event #2 Getting up to Speed!

Winner = Lowest average lap time over 10 consecutive laps (do not stop in between laps).

Event # 3 Further, Faster

Score = $(\text{Number of Laps})^2 \div (\text{Total Elapsed Time})$; Winner = Highest Score

Good Luck.

For more information please contact:

[Contact info removed]

Example Race Sponsorship Form

FastTrack RC

This form was distributed to potential sponsors with the event flier.

Sponsor or Volunteer at a FastTrack RC Event

Students tap into the immense power of STEM.

FastTrack Racing Challenge Overview

The FastTrack RC National STEM League is the 'little league' through which future engineers, scientists, marketing and creative professionals prepare for their futures. In the FastTrack RC, middle and high school students form teams around a 1:10 scale RC car that mirror professional motorsports teams, auto engineers and 'green' transportation designers.

Teams work on projects and compete in racing challenges during the school year. Scores accumulate each month building toward the national finals event in May held at a NASCAR track. Each challenge presents a real problem that cannot be solved in any practical manner simply through trial and error; solutions require the purposeful application of math and science knowledge and skills (problems parallel what professional race teams face each week). Only through scientifically sound investigation can participants maximize scores.

Event Series Overview

During the 2009-2010 FastTrack Racing Challenges Season, students and teachers are invited to compete in a series of three sponsored by The National Guard, hosted by HobbyTown USA and organized by Mallard Creek High School (2008-09 National FTRC Champions).

Participants: Five FastTrack RC teams from Charlotte and two from S. Carolina

Expected Attendees: 150 people per event

Sponsorship Opportunities

Please return form and checks to: *[Contact info removed]*

	Date 1		Date 2		Date 3		Totals
Volunteer my time	-	<input type="checkbox"/>	-	<input type="checkbox"/>	-	<input type="checkbox"/>	-
Provide soft drinks and snacks	\$50	<input type="checkbox"/>	\$50	<input type="checkbox"/>	\$50	<input type="checkbox"/>	
Provide pizza for 50 participants	\$150	<input type="checkbox"/>	\$150	<input type="checkbox"/>	\$150	<input type="checkbox"/>	
Tables rental	\$150	<input type="checkbox"/>	\$150	<input type="checkbox"/>	\$150	<input type="checkbox"/>	
Announcer and DJ setup	\$150	<input type="checkbox"/>	\$150	<input type="checkbox"/>	\$150	<input type="checkbox"/>	
Prizes (tires, batteries, etc)	\$150	<input type="checkbox"/>	\$150	<input type="checkbox"/>	\$150	<input type="checkbox"/>	
Other:		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
Other:							
Sponsor an additional FastTrack RC station and league entry for a an existing FTRC team.	\$589	<input type="checkbox"/>	\$589	<input type="checkbox"/>	\$589	<input type="checkbox"/>	
TOTAL SPONSORSHIP							\$

Standard Race Score Sheet

Team Sheet

FastTrack RC

•• Download the spreadsheet for direct data entry and calculation from the FTRC Team Web Site ••

Team Name: _____
 Car Serial #: _____
 Host Site: _____

School/Org: _____
 Date: _____
 # of Teams: _____

Penalty: 2 seconds added to lap time each time a cone is hit and moved.

Event 1: Go Fast!

Winner = Lowest single lap time out of 4 laps (called the bracket lap time).

	Timer 1	Timer 2	Timer 3	Avg. Total Elapsed Time	Penalties	Net Elapsed Time
Lap 1						
Lap 2						
Lap 3						
						Bracket Time

Instructions: Drive 4 individual laps; three people measure each lap time in seconds. Enter measured times in seconds into the table then calculate the average time for each lap. Add 2 seconds for every penalty to get the Net Lap Time. Define the lowest Net Lap Time as the Bracket Time.

Event 2: Getting up to Speed!

Winner = Lowest elapsed time over 10 consecutive laps (do not stop in between laps).

Instructions: Three cars at a time drive 10 consecutive laps; three people measure total drive time for 10 laps. Enter elapsed time in seconds then calculate the average. Add 2 seconds for every penalty to get the Net Total Elapsed Time.

	Timer 1	Timer 2	Timer 3	Avg. Total Elapsed Time	Penalties	Net Elapsed Time for 10 Laps
For 10 Laps						

Event 3: Faster, Further

Winner = Highest Score, $Score = (Number\ of\ Laps)^2 \div (Total\ Elapsed\ Time)$

Instructions: One to three cars at a time drive continuous laps for up to 10 minutes; three people measure total drive time and count the number of laps. Put a hash mark for each lap. Enter elapsed time in seconds then calculate the average. Add 2 seconds for every penalty to get the Total Elapsed Time then calculate the Score.

Teams must complete the final lap, there can be more than one driver and pit stops are allowed.

	Timer 1	Timer 2	Timer 3	Avg. Total Elapsed Time	# of Laps	Penalties	Net Elapsed Time for 10 Laps
For 10 Laps							

Team Summary

	Event 1	Event 2	Event 3	Competition Score	Participation Points	FTRC League Points
Place (1st, 2nd, etc.)						
Event Points						

Example Race Schedule

Standard Competition with Four Teams

FastTrack RC

•• Download the spreadsheet to customize from the FTRC Team Web Site ••

Example Schedule Four (4) Face-2-Face Teams



Orange X indicates team is on track

Event 1 Time:	10	min
Event 2 Time:	10	min
Event 3 Time:	10	min

Time Between Teams:	0	min
Time Between Event:	10	min
Start Time:	11:30 AM	

Event 1: 4 Individual Laps

Start Time	End Time	Track	Team 1	Team 2	Team 3	Team 4
11:30 AM	11:40 AM	1				
11:40 AM	11:50 AM	1				
11:50 AM	12:00 PM	1				
12:00 PM	12:10 PM	1				

Event 2: 10 Consecutive Laps

Start Time	End Time	Track	Team 1	Team 2	Team 3	Team 4
12:20 PM	12:30 PM	1				
12:30 PM	12:40 PM	1				
12:40 PM	12:50 PM	1				
12:50 PM	1:00 PM	1				

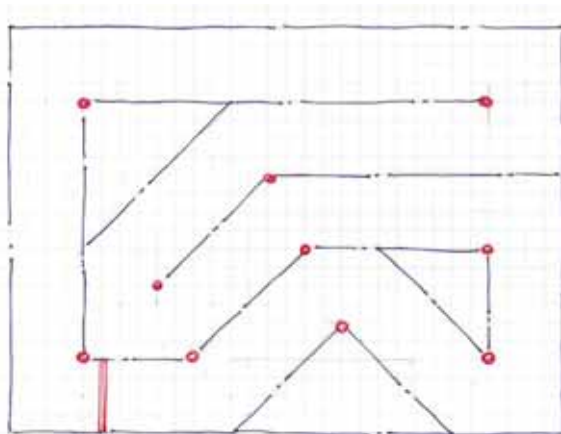
Event 3: Up to 10 minutes track time

Start Time	End Time	Track	Team 1	Team 2	Team 3	Team 4
1:10 PM	1:20 PM	1				
1:20 PM	1:30 PM	1				
1:30 PM	1:40 PM	1				
1:40 PM	1:50 PM	1				

Challenge Tracks

There are 10 track layouts provided by the FastTrack RC sanctioning body. Tracks are drawn to scale so that you can accurately lay them out in your facility.

Visit the FTRC Team Web Site for a video lesson on setting up a track. A brief, but helpful lesson on laying out a track is provided in this section.



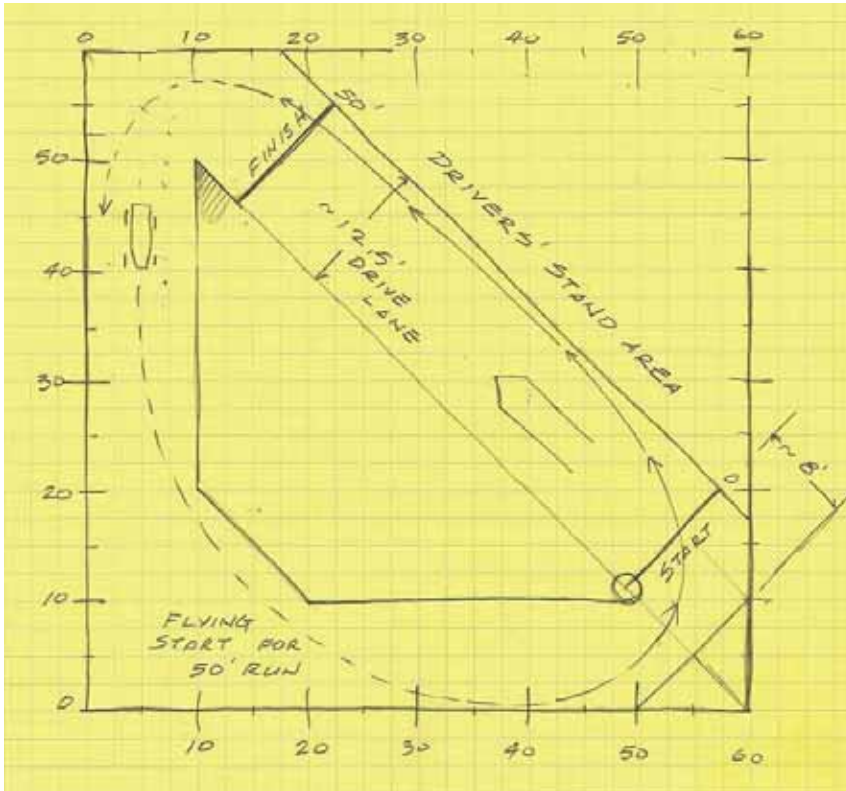
Challenge Track Contents

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Finding The Ideal Drive Path

Once you can drive a track consistently, you can begin to improve on speed. Finding the ideal drive path is often the first step. There are a lot of ways you can take a corner, but there is one way that is faster than others. By finding that ideal drive path (aka drive line), you'll save energy by avoiding unnecessary accelerations and decelerations.



This track to the left is one that fits in a 60 ft. x 60 ft. room.

It is a simple track that can help you practice driving an optimal path around corners.

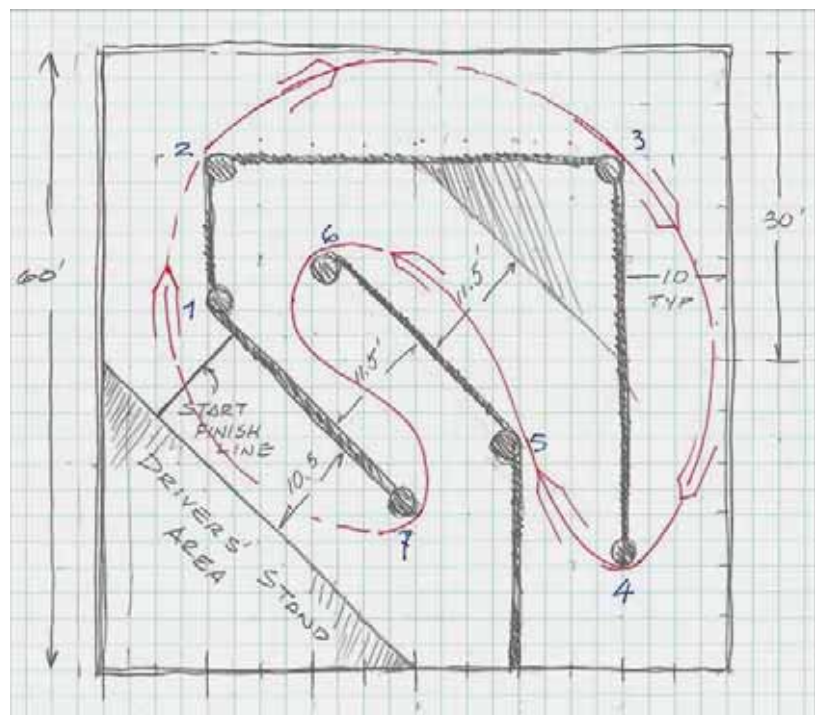
FTRC Resources on finding Optimal Drive Paths

1. Chassis Setup Investigation, Hitting Your Marks, UTurn
2. PPT: Begin at the Beginning
3. Video: Optimal Drive Path
4. Math: Parabolic Drive Paths

This track is very similar to FTRC Track #4. It differs only between turns 7 and 1.

This example shows you one space to set aside for a drivers' stand. If possible, raise the stand so that drivers can see beyond the track boundaries to every spot on the track.

This example also shows you an optimal drive path that minimizes acceleration and deceleration that wastes energy and ultimately slows you down.



Laying Out an FTRC Track

The Key: Cartesian Coordinates

The key to laying out any track is to see the track image as a Cartesian coordinate system.

The track layout is a map organized on a 5 feet x 5 feet grid system. Each point on the track layout is a coordinate on the grid system.

Step 1: Map the Track

In this example, the origin is in the upper right corner and points right and down from the origin are positive. How you orient your track depends on the physical space.

Because Cartesian points define relative locations, make sure everyone on your team uses the same origin and axes. To make your Cartesian Map,

1. Define an origin (0,0) point.
2. Define the directions for positive and negative movement along the X and Y axes.
3. Label the track points relative to the origin.

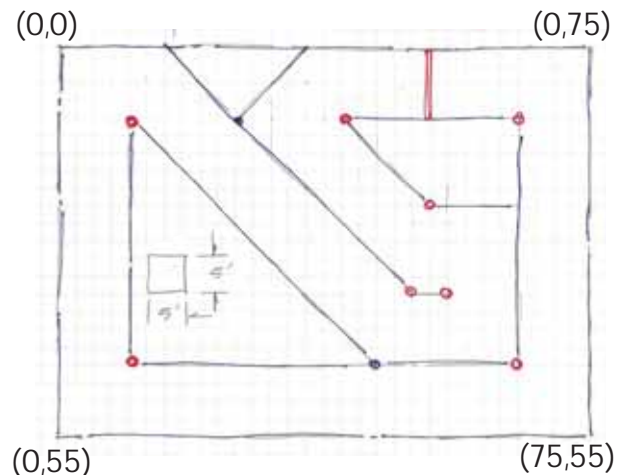
Step 2: Layout the Outer Rectangle

Layout the corners of your full-size rectangle on the ground. Make sure the four corners are square (90°) using a multiple of the 3-4-5 triangle, 12-16-20. Read below and watch the Video, Track Layout: Right Angles, to see why this works.

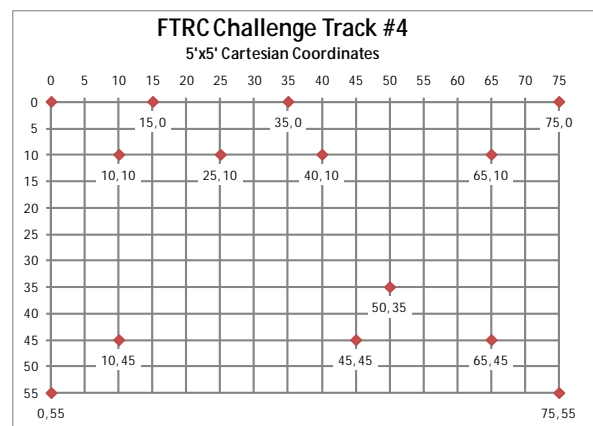
Cut three pieces of rope then tape them together to make a circle. Once taped together, the three parts should be 12 feet, 16 feet and 20 feet long.

Pull the rope tight so that that the two short sides are along the outside of the track. Put tape marks on the ground along the two short sides. Remove the rope then tape down the track boundary on that corner.

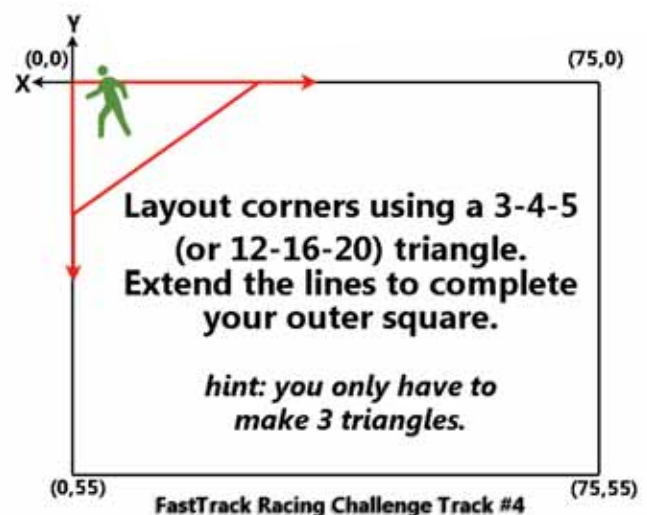
Repeat this for three of the four corners then tape down the outer, rectangular boundary for your track.



(Above) FTRC Track #4 layout
(Below) Cartesian map of Track #4



For details on how, watch the video
Track Layout: Right Angles.



Step 3: Mark 5' Grid Lines

Make the grid lines on your 75x55 feet cartesian coordinate system. Along the X and Y axes, put a piece of tape every five (5) feet.

Step 4: Plot Each Track Point

Mark each dot on your track. For example, there are points along the X-axis at (15,0) and (35,0). There are points at (10, 10), (25,10) (40,10) and (65,10). Mark them all.

Step 5: Connect Dots to Make Lanes

Connect all of the dots so that the lane boundaries match the track layout drawing. Put cones over each point to make the drive path more clear.

Step 6: Finishing Touches

Put cones over each point to make the drive path more clear.
Mark the Start-Finish Line.

3-4-5 Triangles (Pythagorean Theorem)

Over 4,000 years ago, before Pythagoras (569 - 475 BC) came along and formally advanced geometry as a scientific study, the Egyptians used the principal of 3-4-5 triangles to build the Great Pyramids.

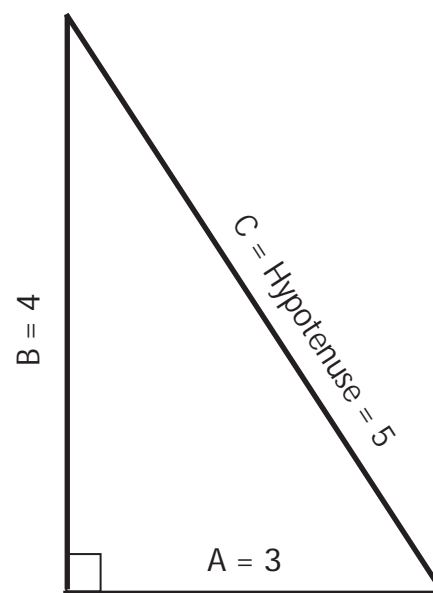
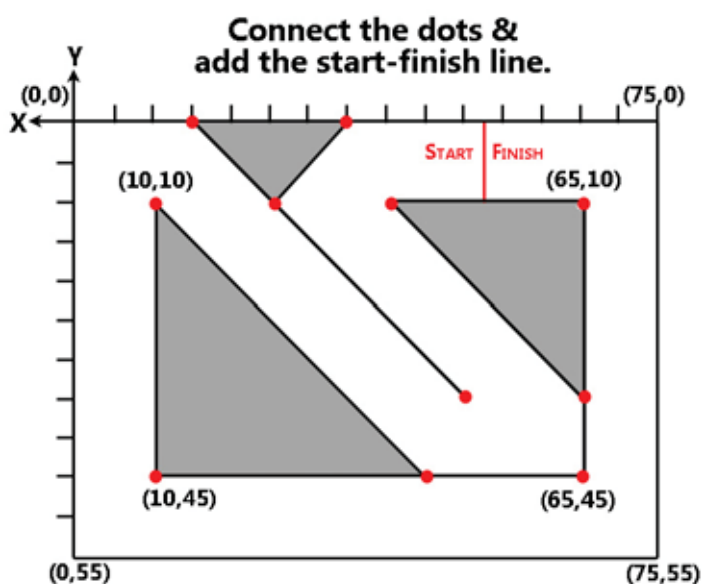
3-4-5 are Pythagorean triples, meaning that they represent three sides of a right triangle. If the three sides are 3, 4 and 5 units in length, the angle between the 3 and 4 sides will be a right, 90° angle. 3, 4, and 5 are very convenient, whole numbers to work with, but there are many combinations that give a right triangle. The Pythagorean Theorem describes the relationship.

Pythagorean Theorem:

$$A^2 + B^2 = C^2$$

where A and B are two sides of a triangle and C is the third, longest side called the hypotenuse.

Any multiple of 3,4 and 5 give you a right triangle. 6-8-10 and 12-16-20 give you a 90° angle. These bigger sides make it easier to extend the sides into long lines when you're laying out something physical like a track or deck.

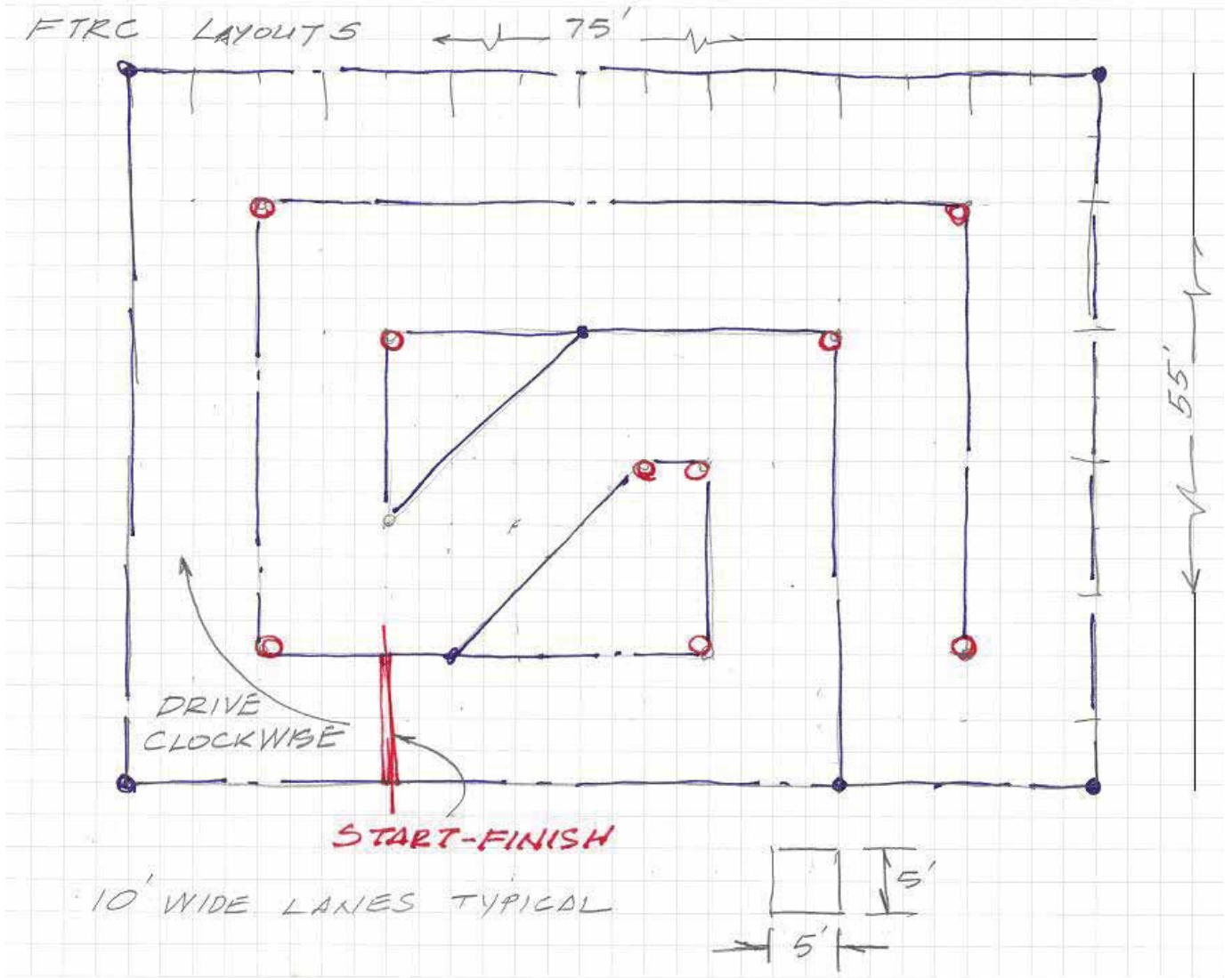


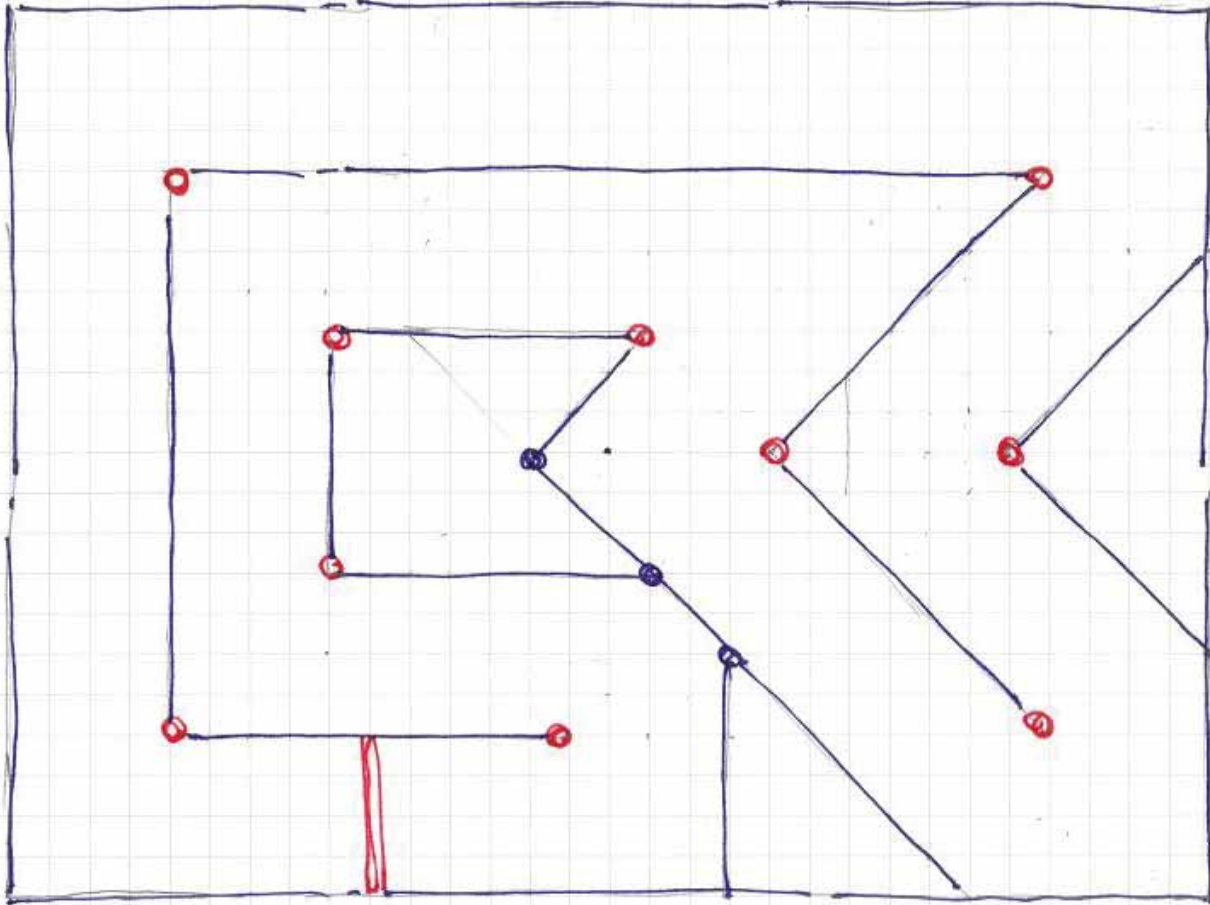
Pythagorean Theorem: $A^2 + B^2 = C^2$

$A=3, B=4$ and $C=5$ is a convenient set that complete this equation.

FTRC Track 1

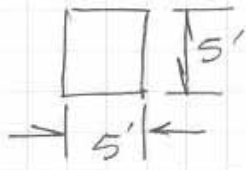
FastTrack RC





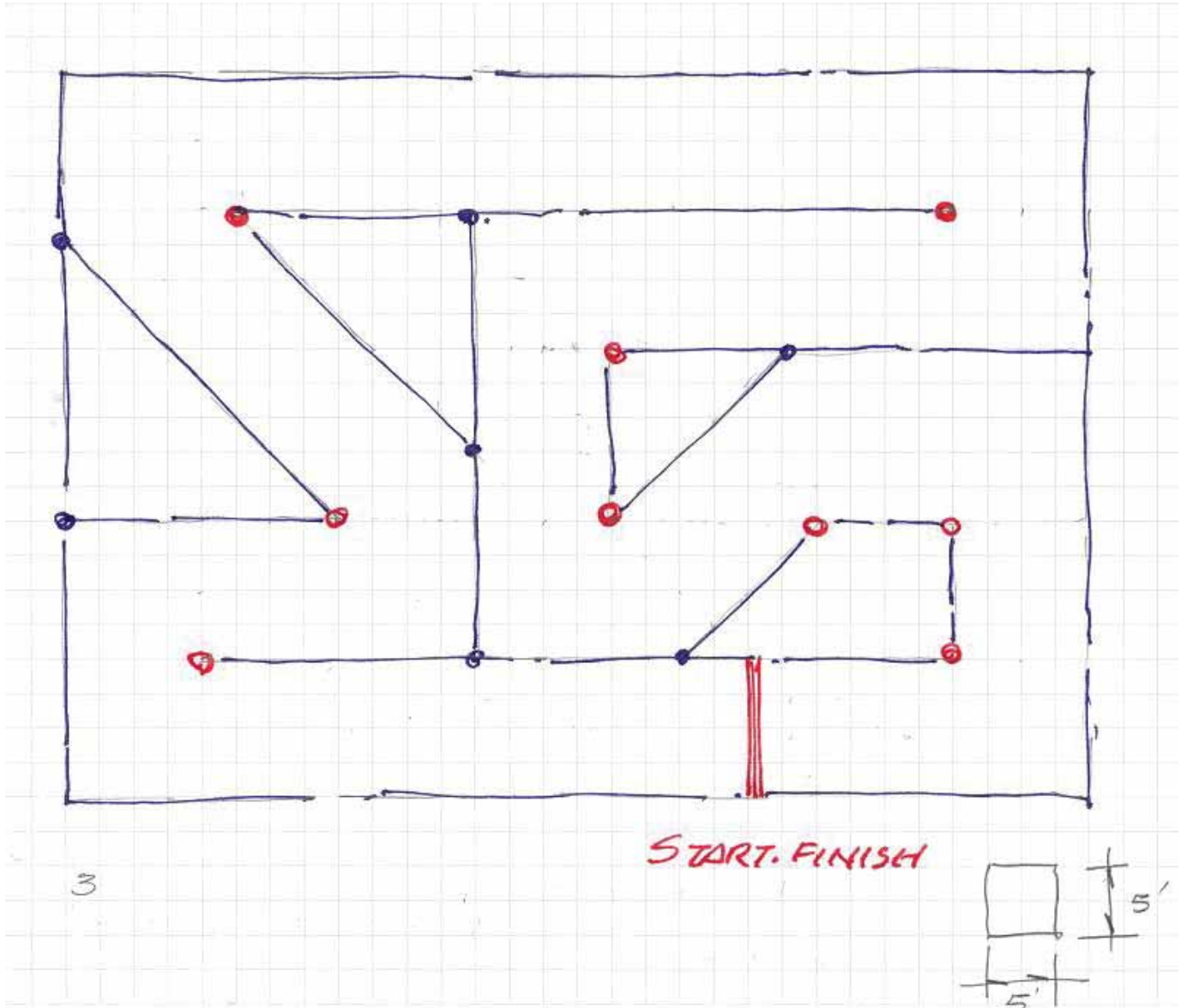
START-FINISH

2



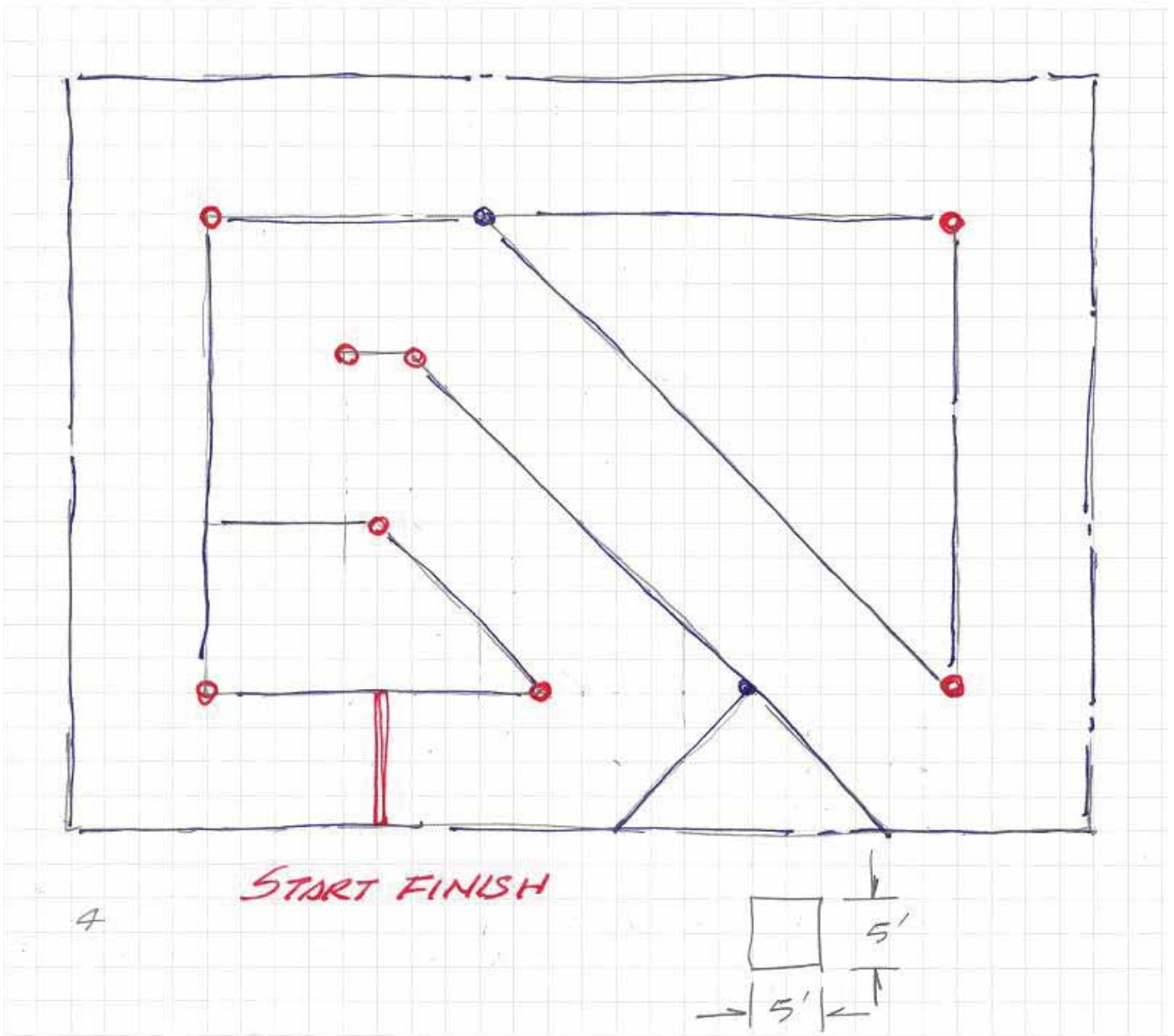
FTRC Track 3

FastTrack RC



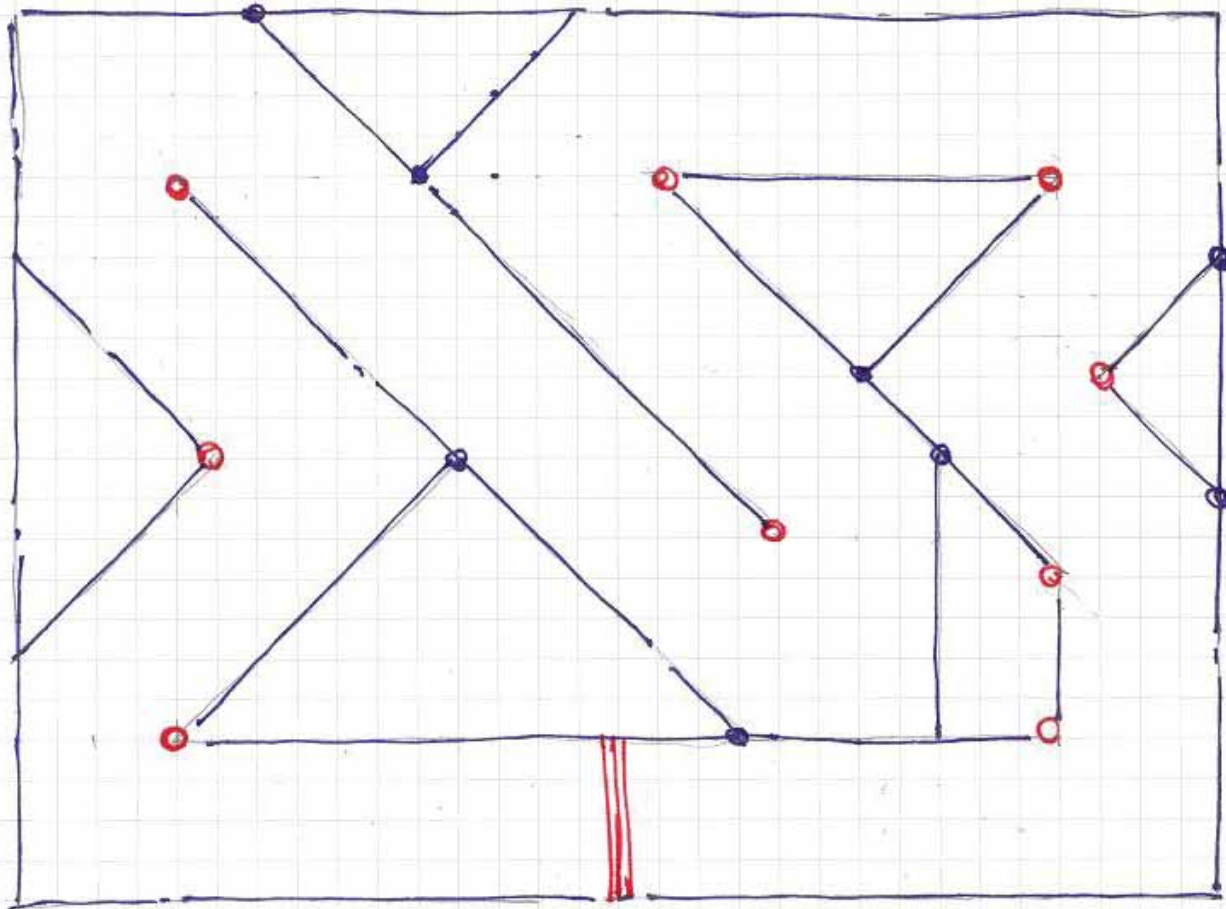
FTRC Track 4

FastTrack RC



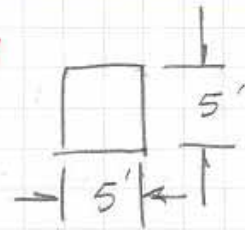
FTRC Track 5

FastTrack RC



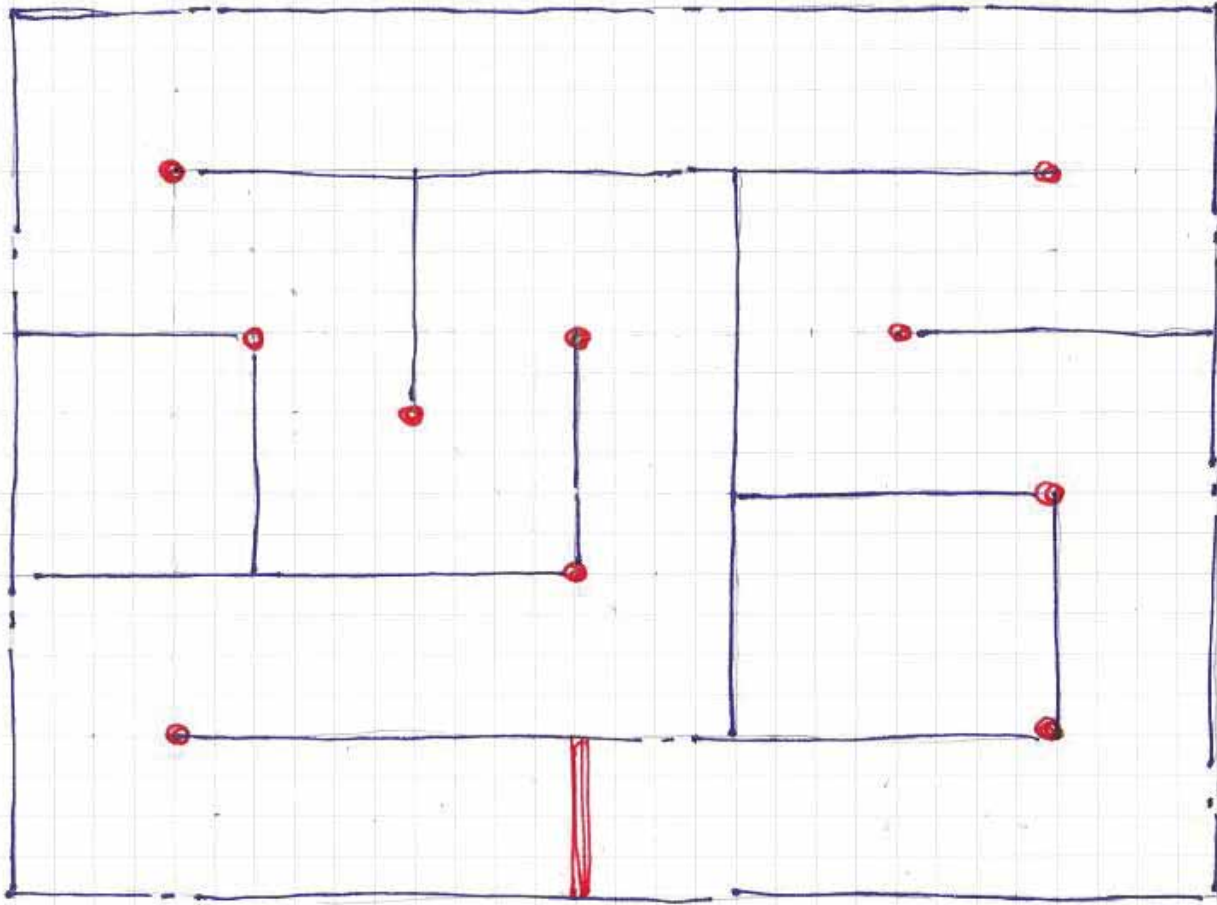
5

START-FINISH



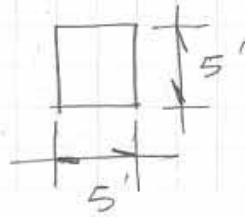
FTRC Track 7

FastTrack RC



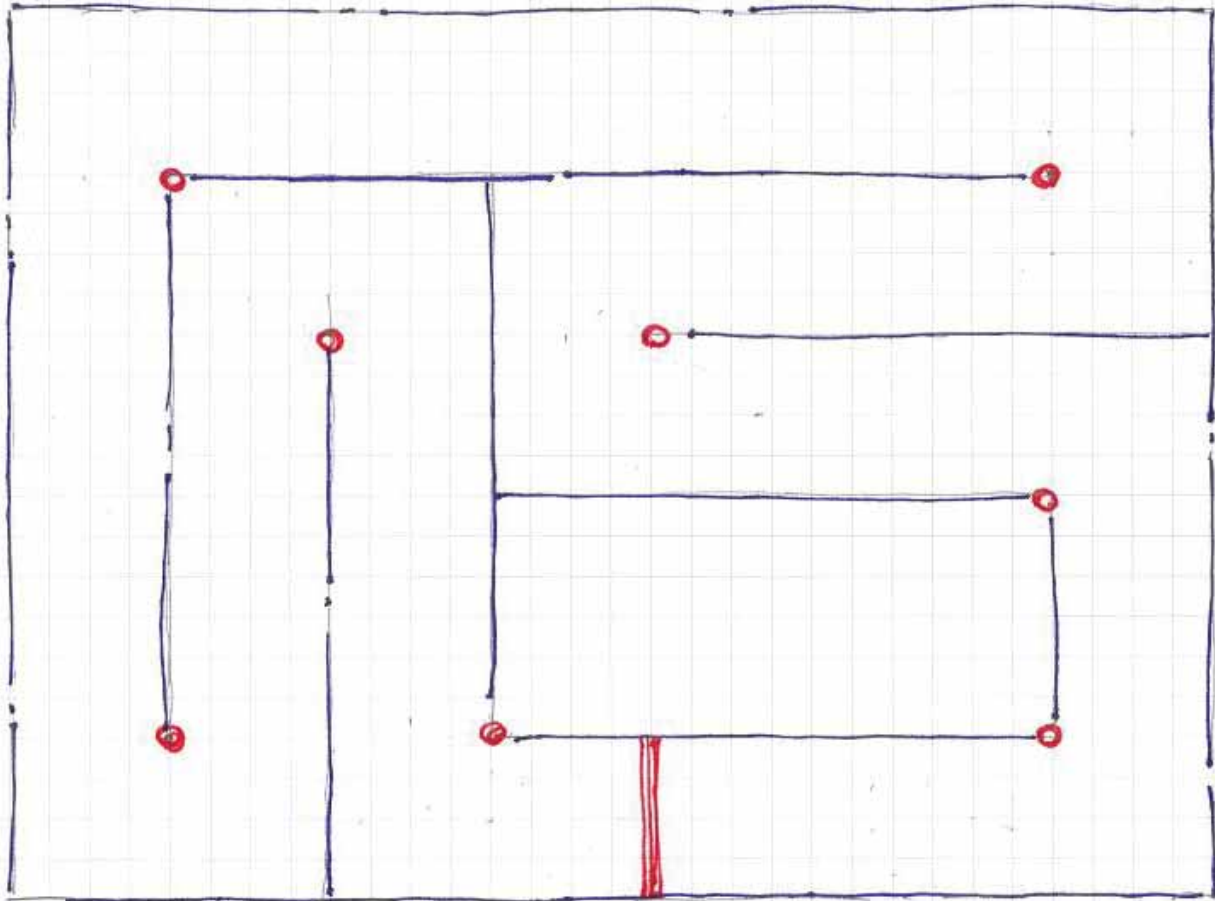
START FINISH

7



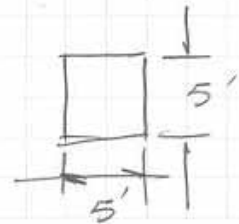
FTRC Track 8

FastTrack RC



8

START FINISH



To claim points, submit evidence of your work and other information on the points form. You can submit the form and documentation of your work in one of four ways:

1. eForm: Use e-form on FastTrack RC Team Web Site to enter info and upload documentation.
FTRC Team Web Address: <http://mindbugs.mrooms.net>
2. Email: Download PDF form, complete then email with documentation.
Email address: reporting@ten80education.com
3. Fax: Copy, complete then fax paper forms from this section with documentation.
Fax: 1-518-533-3804
4. Mail: Copy, complete then mail paper forms from this section with documentation.
Address: 26F Congress St. #338; Saratoga Springs, NY 12866

Points Form Contents

Points Form: Race Engineering.....	2
Points Form: Business Planning.....	3
Points Form: Project Management.....	4
Points Form: Team Identity.....	5
Points Form: Public Relations.....	6
Points Form: Web & Networking Sites.....	7
Points Form: Media Exposure.....	8
Points Form: Car Decal Design.....	9
Points Form: Race Results Reporting (Page 1 of 2).....	10
Points Form: Monthly Challenge.....	12



FastTrack RC 2010-11 Season
Points Form: Race Engineering

Required Documentation

- This form
- Investigations: Data set and analysis
Projects: Design sketches, concept and detailed design testing, picture of final product
SolidWorks Tutorials: SolidWorks file(s) and isometric drawing

Team Info

Name: _____ School/Organization: _____

Phone: _____ Email: _____

Car #'s: _____

Documentation of Investigation or Project

Submission Date: _____ Type of File: _____

FTRC Investigation or Project Name: _____

Share details about your process, analysis and/or conclusions.

Continue on the back or on another page.

FastTrack RC 2010-11 Season
Points Form: Business Planning

Required Documentation

- This form
- Business Plan Document
- 3-8 minute presentation file (PowerPoint file, Video or other similar recording of the presentation, Keynote file)

Team Info

Name: _____ School/Organization: _____

Phone: _____ Email: _____

Car #'s: _____

Documentation of Business Plan

Submission Date: _____ Document File Type: _____

Presentation File Type or URL if posted online: _____

Share details about your planning process and how you have already or will use it.

Continue on the back or on another page.

FastTrack RC 2010-11 Season
Points Form: Project Planning

Required Documentation

- This form
- Project Plan

Team Info

Name: _____ School/Organization: _____

Phone: _____ Email: _____

Car #'s: _____

Documentation of Project Plan

Submission Date: _____ File Type: _____

Share details about your planning process and how you will use this plan.

Continue on the back or on another page.

**FastTrack RC 2010-11 Season
Points Form: Team Identity**

Required Documentation

- This form
- Team Identity File (JPG, PDF, etc.) that includes picture of logo, color scheme and other documents defining visual use
- Example of team logo on merchandise

Team Info

Name: _____ School/Organization: _____

Phone: _____ Email: _____

Car #'s: _____

Documentation of Team Identity

Submission Date: _____ Type of File: _____

What example are you submitting? (ex. T-shirt, car body, etc.): _____

Share details about your planning process and how you used this plan.

Continue on the back or on another page.

FastTrack RC 2010-11 Season
Points Form: Public Relations

Required Documentation

- This form
- PR Strategy & Plan: Copy / Document of PR strategy and/or plan
PR Materials: Copy / Document of materials

Team Info

Name: _____ School/Organization: _____

Phone: _____ Email: _____

Car #'s: _____

Documentation of Marketing Activities

Submission Date: _____ Type of File (PDF, DOC, etc.): _____

What are you submitting? PR strategy, plan, PR materials? : _____

If PR materials, what type? : _____

Share details about your design process.

Continue on the back or on another page.

FastTrack RC 2010-11 Season
Points Form: Web & Networking Sites

Required Documentation

- This form
- Link to site(s)
- Number of links, favorites, followers, etc. you are claiming

Team Info

Name: _____ School/Organization: _____

Phone: _____ Email: _____

Car #'s: _____

Documentation of Web Design and Links/Favorites/Followers

Submission Date: _____ Web Software used to Design: _____
if applicable

Type of Link(s): _____ Number of Links, favorites, etc: _____
hyperlink, favorites, followers, etc. if applicable

Web URL's: _____

Share details about your design process and how you achieved the links and/or followers.

Continue on the back or on another page.

FastTrack RC 2010-11 Season
Points Form: Media Exposure

Required Documentation

- This form
- Evidence of the coverage (pictures, screen shots, copies of article, video/audio files, etc.)

Team Info

Name: _____ School/Organization: _____

Phone: _____ Email: _____

Car #'s: _____

Documentation of Media Exposure

Submission Date: _____ Publication Date: _____

Media Format: _____ Professional or Non-Professional: _____
print, radio, TV, web, etc.

Extent of Coverage: _____ Web Links: _____
of lines, air time, etc. *if applicable*

Publication Name: _____

Share details about the coverage and how you achieved it.

Continue on the back or on another page.

FastTrack RC 2010-11 Season
Points Form: Car Decal Design

Required Documentation

- This form
- Car Decal Design (pictures, copies, etc.)
 - » 2-D design
 - » 3-D as installed on the car body
- Adobe Illustrator file if you were able to use that program for design

Team Info

Name: _____ School/Organization: _____

Phone: _____ Email: _____

Car #'s: _____

Documentation of Design

Submission Date: _____ Software used to Design 2-D: _____

Software used to Design 3-D: _____

How did you apply the design to the car body?:

Share any other details of your inspiration, motivation, design and application.

Continue on the back or on another page.

FastTrack RC 2010-11 Season
Points Form: Race Results Reporting (Page 1 of 2)

Required Documentation

- This form
- Race data sheet (copy or e-file)
- Please also share your organizational documents like invitations, rules, etc.

Sanctioning Official's Info

Name: _____ School/Organization: _____

Phone: _____ Email: _____

Your Car # (at least one): _____

Event Information

Event Date and time: _____ Race: Face-2-Face Web

Race Events: Go Fast Getting Up to Speed Up to Speed Faster, Further Exponentially Faster, Further Pit Stop Drag Race Aero Track Other _____

Non-Race Events: Team Presentation Car Body Decal Team Identity Business Plan

Number of Participating Schools/Organizations: _____ Number of Participating Teams: _____

Host Venue: _____

Host City, State ZIP: _____

Describe the Competition Surface (rough or smooth asphalt, gym floor, tennis court, etc):

Give an Example C_F if you have one:

Describe the Weather Conditions if outside (temp, windy, sunny/cloudy, wet/dry, etc.)

Points Form: Race Results Reporting (page 2 of 2)

Enter information for all teams that participated.
For each team, enter the final COMPETITION SCORE = Event 1 + 2 + 3 + 4

School/Organization	Car #	Team Name	# Players	Web or F2F	Event 1 Points	Event 2 Points	Event 3 Points	Other Event Points	Com- petition Score	Rank
										1
										2
										3
										4
										5
										6
										7
										8
										9
										10
										11
										12

By signing this, I am stating that I inspected the cars used by the top 5 teams and enforced all rules outlined in the *FTRC Rules & Guidelines*. I hereby certify the results of this competition as stated above.

Name, print: _____

Signature: _____ Date: _____

FastTrack RC 2010-11 Season
Points Form: Monthly Challenge

Required Documentation

- This form
- Documentation Requested by the Monthly Challenge announcement

Team Info

Name: _____ School/Organization: _____

Phone: _____ Email: _____

Car #'s: _____

Documentation of Media Exposure

Submission Date: _____

File Type(s): _____
PDF, Video, Word Doc, Keynote, etc.

Web URL(s): _____
if applicable

Share details about how you addressed the challenge.

Continue on the back or on another page.

2009-10 FastTrack RC National Finals Daytona International Speedway



Check out the winners at www.fasttrackrc.com/FinalsResults.html



Drawing by Ten80 Education's own Professor Pi (a.k.a. Jeff Thompson, Mechanical Engineer)
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