**ROYAL CANADIAN ARMY CADETS**

**GOLD STAR**

**INSTRUCTIONAL GUIDE**

**SECTION 3**

**EO M426.02B – RIDE A MOUNTAIN BIKE**

Total Time: 270 min

## PREPARATION

### PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-704/PG-001, *Gold Star Qualification Standard and Plan*, Chapter 4. Specific uses for said resources are identified throughout the instructional guide within the TP for which they are required.

Review the lesson content and become familiar with the material prior to delivering the lesson.

Every cadet must have a water carrier prior to the start of this lesson.

All mountain bikes and helmets being used should be organized by size prior to the start of this lesson.

Have mountain bike pumps and mountain bike repair kits available to complete the pre-ride check.

Have cleaning materials available to complete the post-ride check.

Review the terrain and trail features of the mountain bike route. Be aware of challenging areas where cadets may require additional supervision.

### PRE-LESSON ASSIGNMENT

Nil.

### APPROACH

The experiential approach was chosen for this activity as it allows the cadet to acquire new knowledge and skills through a direct experience. The cadet experiences mountain biking on familiarization / intermediate trails during an expedition and defines the experience on a personal level. The cadet will be given the opportunity to reflect on and examine what they saw, felt and thought while mountain biking and consider how it relates to what they already learned and experienced as well as how it will relate to future experiences.

## INTRODUCTION

### REVIEW

Nil.

### OBJECTIVES

By the end of this lesson the cadet shall have ridden a mountain bike on familiarization / intermediate trails during an expedition.



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**IMPORTANCE**

It is important for cadets to be able to ride a mountain bike on familiarization / intermediate trails during an expedition. Cadets will be required to work as a member of an expedition team to travel a significant distance during the expedition. Being able to perform basic mountain bike skills will assist them in keeping up with their team. Mountain biking over more difficult terrain features will provide cadets the opportunity to put into practice new mountain bike skills while further developing their basic mountain bike skills in an environment that challenges them both physically and mentally.



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**Teaching point 1** **Ride a mountain bike on familiarization / intermediate trails during an expedition.**

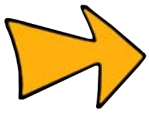
Time: 270 min Method: Experiential

## BACKGROUND KNOWLEDGE




The TP for this lesson will occur during the mountain bike portion of the expedition. In most situations cadets will have already received instruction and been provided the opportunity to practice basic mountain bike skills during the Silver Star Expedition / at the CTC. The requirement to review skills will be based on the experience level of the cadets and the expedition training centre. Should a review be required, it is suggested that it is completed along the route as the need arises.

## SELECTING AND ADJUSTING A MOUNTAIN BIKE



Since the first introduction of the mountain bike in the mid- to late-1970s, the design of bikes has evolved. The quest for improved products has led to continued improvements and advancements in materials being used to construct the bikes, as well as the overall design of the bikes themselves. With the introduction of new bikes each year by key manufacturers the use of stronger and lighter materials, and cutting edge designs compete to maximize speed, power and strength.

While it is important to have a well-designed mountain bike, if the bike chosen does not fit the mountain biker the excellence in design will be lost. Having a properly-fitted mountain bike is important for riding efficiency and power, as well as safety. When a mountain bike does not fit the mountain biker properly, injuries are more likely.

### Selecting a Helmet

A properly-fitted helmet should:

- fit level and square on the head;
- cover the front of the forehead;
- sit snug on the head, without fastening the chin strap;
- not slip when the head moves; and
- have straps adjusted to meet just below the ear and fastened tightly.



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*Note. From Cycling Skills: Cycling Safety for Teen and Adult Cyclists by Ministry of Transportation Ontario, 2005, Copyright 2005 by Government of Ontario. Retrieved October 5, 2007, from http://www.mto.gov.on.ca/English/pubs/cycling/cyclingskills.htm*

Figure 1 Proper Fit of a Helmet

Helmet sizes vary from extra small to extra large. It is important to try on a variety of sizes to make sure the fit is correct.

**Adjusting the Helmet**

A helmet will not necessarily fit without making some minor adjustments. The following are some basic adjustments that can be made to ensure the helmet will protect the mountain biker in an accident:

1. Adjust removable pads, if required, to make the fit firm and comfortable.

2. Centre the chin clip so it is just under the chin and so the strap is even on both sides. This is done by pulling the strap from one side to another through the underside of the helmet.

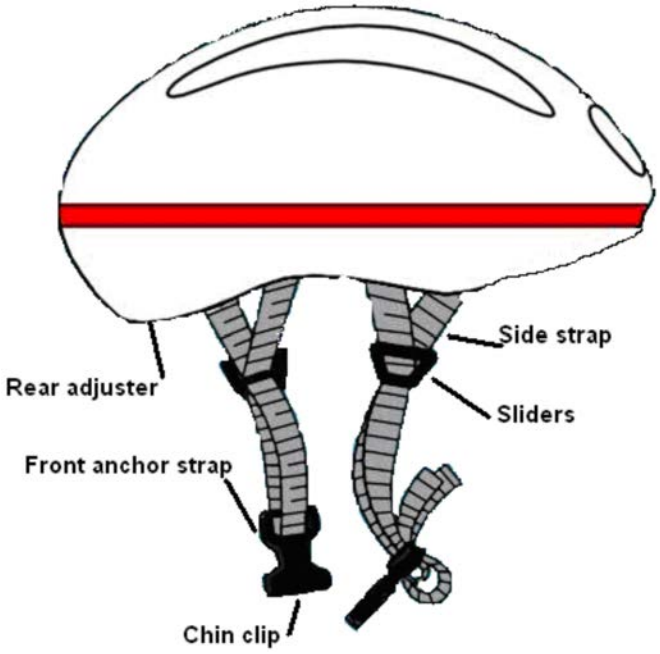
3. Adjust the side straps by pulling or pushing them through the sliders. The slider should sit just below the ears, forming a 'V'.

4. Use the rear adjuster (if there is one) by sliding the mechanism to make it bigger or smaller.

5. Buckle the chin clip and ensure no more than two fingers can fit under it.



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*Note. From CPSC Issues New Safety Standard for Bike Helmets by U.S. Consumer Product Safety Commission. Retrieved October 30, 2007, from http://www.cpsc.gov/cpscpub/prerel/prhtml98/98062.html*

Figure 2 Parts of a Helmet

**Selecting a Mountain Bike**

While some manufacturers size their mountain bikes by labelling them as small, medium, large and extra large, in most cases mountain bike size is given in inches and is based on leg length. The frame size is determined by measuring the distance from where the crank attaches to the mountain bike to the intersection of the seat tube and the top tube.




*Note. From Bike Sizing Guide by Dynamic Bicycles, 2005 , Copyright 2005 from Dynamic Bicycles, Inc. Retrieved October 31, 2007, from http://www.dynamicbicycles.com/bikes/sizing.php*

Figure 3 Sizing Measurements



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The following steps should be followed when sizing a mountain bike:

1. **Size by eye.** The initial step in sizing a mountain bike is to select a mountain bike with a frame size that coincides with the height of the mountain biker.

2. **Stand-over test.** The next step is to straddle the mountain bike. There should be minimum 5-cm (2-inch) clearance between the top tube and the crotch when the mountain biker is straddling the mountain bike.

3. **Saddle adjustment.** Standing next to the mountain bike, the mountain biker will adjust the saddle height to just above their hip by opening the seat post release, raising or lowering the saddle, and closing the release. The mountain biker will then sit on the saddle, and place their left foot on the pedal with the ball of the foot over the centre of the pedal. The left leg should be almost perpendicular, without the knee locking.

**COMPLETE A PRE-RIDE BIKE CHECK**

Mountain biking is incredibly hard on the mountain bikes and equipment. Before the start of a ride it is important to run through a pre-ride check to ensure the mountain bike is in the best possible condition for riding. It may seem redundant to do this before every ride, especially when a post-ride check was completed; however, it only takes one broken cable or one flat tire to ruin a ride.

The ABC Quick Check is an easy way to remember what parts of the mountain bike should be checked during a pre-ride check. The check is a series of questions that the mountain biker must ask themselves, in relation to five areas of the mountain bike. The ABC Quick Check should be practiced so that it can be done quickly and efficiently. The mountain biker will correct any minor issues at the time of the pre-ride check; any major issues, or those that require a mountain bike tool, will have to be brought to the attention of the ride leader.

**AIR**

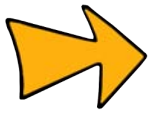
The first step in the ABC Quick Check begins by focusing the mountain biker's attention on the wheels and tires of the mountain bike.

Do the tires have enough air?

This can be checked using a bicycle pump that has a built-in tire pressure gauge. The tire pressure for mountain bike tires should be between 35 pounds per square inch (psi) (240 kpa) and 65 psi (448 kpa).



When pumping the tires, aim to ensure the tire pressure is between 45–50 psi (310–345 kpa). This will allow for a variety of trail conditions.



Different trail conditions require different tire pressures. Harder surfaces are easier to ride with harder tires; (50–65 psi [345–448 kpa]), and conversely, softer surfaces are easier with softer tires; (35–40 psi [240–275 kpa]).

Is there any excessive wear on the tread or any cuts on the side walls of the tires?

Any loose or engrained mud or debris that is lodged in the tread should be removed. This will help eliminate the possibility of sharp objects working their way through the tire casing into the inner tube, causing a flat.

**BRAKES**

Next the mountain biker will inspect the front and rear brakes of the mountain bike. It is important to spend time inspecting the brake levers, as well as the actual braking mechanism.

Do the brake levers work effectively?



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There should be at least two finger's distance between each brake lever and the handlebar when pulled. It should require little effort to engage the brake lever. If it is hard to pull then the brake cables require adjustment.



*Note. From Young Cyclists Guide by Ministry of Transportation Ontario, 2005, Copyright 2005 by Government of Ontario. Retrieved November 5, 2007, from http://www.mto.gov.on.ca/English/pubs/cycling/youngcyclists.htm*

Figure 4 Brake Lever Positioning

Do the brakes function as they are supposed to?

The front and rear brakes should be checked independently. The mountain biker should stand beside the mountain bike and push it forward by the handlebars. When the front brake lever is pulled, on its own, the rear wheel should lift up as the front wheel locks. When the rear brake lever is pulled, on its own, the rear wheel should lock and slide across the ground.

**Chain and Crank**

The chain and crank are what make the mountain bike move forward. If they are not in good working order the mountain bike will be difficult to manoeuvre and will most likely not get very far.

Is the chain on and lubricated?

The chain should be able to move freely around the front and rear sprockets when the pedals are moved with no visible signs of bends or kinks. There should be no evidence of rust on the chain. If there is, an application of lubricant should work out the rust.



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*Note. From Young Cyclists Guide by Ministry of Transportation Ontario, 2005, Copyright 2005 by Government of Ontario. Retrieved November 5, 2007, from http://www.mto.gov.on.ca/English/pubs/cycling/youngcyclists.htm*

Figure 5 Lubricating the Chain

Do the pedals spin freely?

The mountain biker should lift up the rear wheel and move the pedals with one hand to check the functionality.

**Quick Release**

Quick release levers are located on the front and rear wheels, as well as the seat post.

Are the wheel quick releases working?

Open and close both the front and rear tire quick release levers. They should be easy to open and close. If not, lubricant should be applied. Ensure they are fully tightened following the check and that the lever is flush with the fork of the mountain bike.



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Figure 6 Quick Release Incorrect Position–Example 1

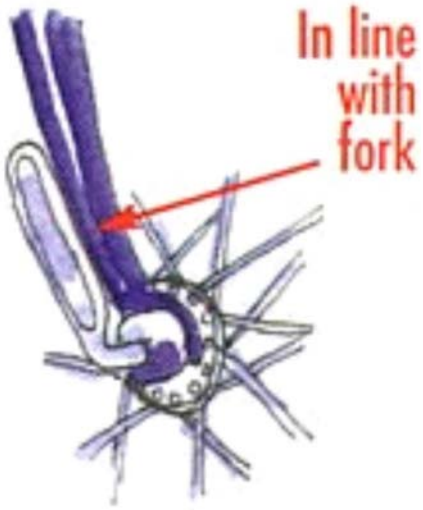


*Note. From Young Cyclists Guide by Ministry of Transportation Ontario, 2005, Copyright 2005 by Government of Ontario. Retrieved November 5, 2007, from http://www.mto.gov.on.ca/English/pubs/cycling/youngcyclists.htm*

Figure 7 Quick Release Incorrect Position–Example 2



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Figure 8 Quick Release Correct Position

Is the saddle quick release working?

Open and close the lever to ensure that it is in good working order. It should be easy to open and close. If not, lubricant should be applied. When closed the lever should be flush with the seat post, pointing towards the back of the mountain bike.

**Final Check**

Finally, the mountain biker should complete a final check of their mountain bike. The mountain bike should be lifted five to seven centimetres (two to three inches) off the ground and then dropped in a controlled manner. When it drops the mountain biker should be listening for sounds associated with loose parts (clings / clangs / pings).

**IDENTIFY SAFETY PERCAUTIONS WHICH MUST BE ADHERED TO WHEN MOUNTAIN BIKING**

Keeping safe on mountain bikes is part common sense and part informed risk-taking, together with a healthy dose of good judgment. Preventing injuries is far easier than seeking medical attention after the fact. Following basic trail and road safety rules will ensure that the ride is safe, not only for the mountain biker but for all trail users.




Investigate the specific rules and regulations associated with mountain bike safety for your province or territory to pass along to cadets in conjunction with the material presented in this TP.

Each province and territory has specific rules and regulations in relation to mountain bike safety. Bikes are the smallest vehicles on the road which makes it very important for mountain bikers to be as visible as possible to other road users at all times.

**Rules of the Road**

Each province has specific rules of the road which form laws within the province. In Ontario, these rules are stated in the *Highway Traffic Act* (HTA).



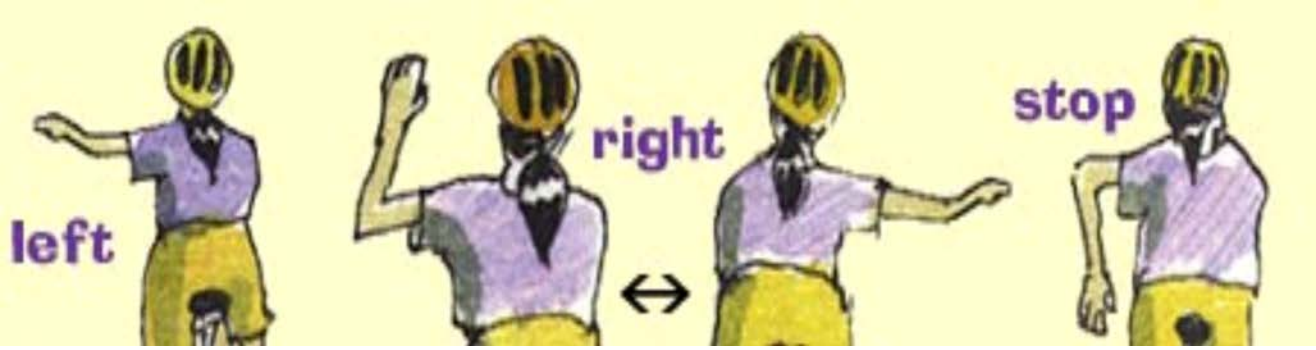
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Some important rules that cyclists should know are:

- A mountain bike is a vehicle and as a cyclist, the same rights and responsibilities apply as to other road users.
- Stop at red lights and stop signs, and travel in the designated direction on one-way streets.
- A mountain bike is a slow vehicle and must travel as far to the right as possible, except when preparing for a left turn or passing. Ride out from the curb far enough to maintain a straight-line path.
- Never compromise safety for the convenience of a motorist; use any part of a lane if the safety of the mountain biker requires it.
- Stop for pedestrians at crosswalks, and walk the mountain bike across crosswalks.
- Stop for school buses when the upper red lights are flashing and the stop arm is out.
- Stop 2 m (6.5 feet) behind streetcar doors and wait until the passengers have boarded or reached the curb.
- Do not attach a mountain bike to a vehicle to hitch a ride.
- Do not ride on expressways, freeways or on roads where "No Bicycle" signs are posted.
- Mountain bikers must correctly identify themselves when stopped by the police for breaking traffic laws.

**Signalling**

When riding a mountain bike on the road it is important to ensure that drivers of motor vehicles are aware of the biker's direction of travel at all times. Making a surprise turn in front of a car is dangerous to both the mountain biker and the driver. Demonstrating proper hand signals will help to eliminate some of the risk associated with riding a mountain bike on roadways.




*Note. From Young Cyclists Guide by Ministry of Transportation Ontario, 2005, Copyright 2005 by Government of Ontario. Retrieved October 5, 2007, from http://www.mto.gov.on.ca/English/pubs/cycling/youngcyclists.htm*

Figure 9 Hand Signals

**Riding Discipline**

Whether riding a mountain bike on the side streets of town or on a double track in a conservation area, demonstrating awareness for the other mountain bikers will ensure that everyone has a safe ride. Ride discipline is a multi-faceted term that coincides with a variety of aspects of mountain biking, from personal and group organization, to stopping and starting procedures.

Riding in a group is one of the safest ways to ride. It is important to remember that each mountain biker is responsible for the person following them. Always have visual contact with the mountain biker behind. If, when looking back, the other mountain biker is not visible, stop and wait for a moment. If the mountain biker does



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not appear in a reasonable amount of time, call a halt to the mountain bikers ahead, and go back and look for the other mountain biker.

There are a few safety tips to keep in mind when travelling in groups:

- Ride in single file on roads and trails as much as possible.
- The lead mountain biker must communicate turns, obstacles and changes in momentum to the remainder of the group through hand signals and voice commands.
- Keep at least 1 m (3.2 feet) between mountain bikers in the group on flat ground.
- When descending hills, keep at least 3 m (9.8 feet) between mountain bikers.
- When ascending hills, stay in single file and keep to the right.
- When stopping, ensure the entire group is completely off the trail or road.
- When stopped, all group members should get off their mountain bikes, turn mountain bikes so they are facing the road, close in ranks and stand to the left of their mountain bikes.
- If travelling on roads in a large group, break into smaller groups of about 10 with at least 1 km (0.62 miles) between each group to allow traffic to pass.
- Road crossings should be completed with the group lining up parallel to the other side of the road and then, in line, walking their mountain bikes across.

**PERFORM MOUNTAIN BIKE SKILLS**

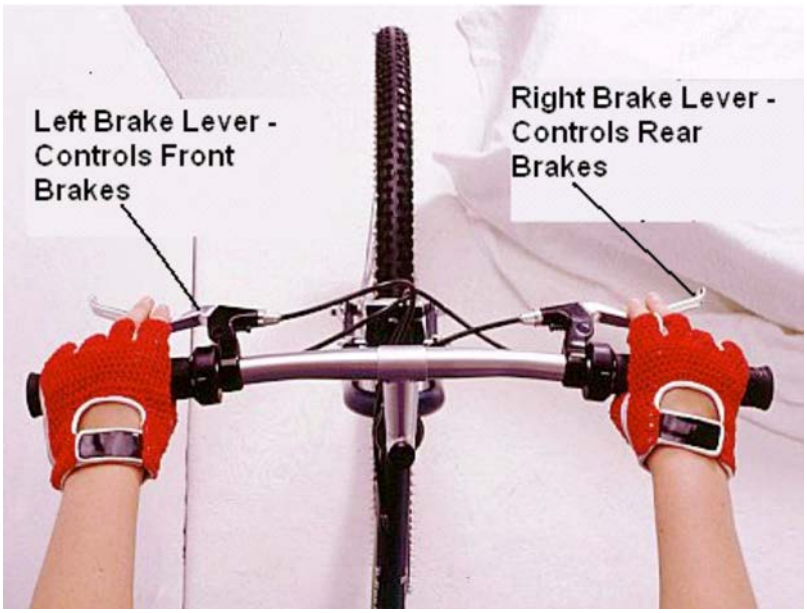
**Braking**

Braking is used not only for stopping, but for slowing down and controlling the mountain bike on roads and trails. It is important for a mountain biker to be able to judge the amount of pressure to use and when to brake for various situations while on the roads and trails. This knowledge will ensure personal safety as well as the safety of other mountain bikers and trail users.

The left-hand brake lever controls the front brake while the right-hand lever controls the rear. Most braking is completed by the right hand, rear brakes, with the left adding assistance as required.



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*Note. From Sports, Games, Recreation, Mountain Biking by DK Images, 2007, Copyright 2007 by DK Limited. Retrieved November 5, 2007, from http://www.dkimages.com/discover/Home/Sports-Games-Recreation/Outdoor-Adventure/Mountain-Biking/index.html*

Figure 10 Braking Hand Position

Riders should be cautioned against using the left brake lever by itself. While this will stop the mountain bike, the forward momentum may cause the mountain biker to continue over the front of the handlebars and mountain bike, resulting in a possible injury.

**Shifting Gears**

Terrain can change quickly when mountain biking. The ability to time a perfect gear shift is a crucial mountain bike technique to master. Smooth shifting makes the difference between a smooth, easy ride and a rough, hard ride. Gear components are equipped with pre-set gears and ramps built into the chainrings and cogs to help the chain move smoothly from one to another. The mountain biker has to shift to the correct gear at the appropriate time.

Gearing adjusts the pedalling load so the mountain biker can adapt to changes in terrain. A gear is described by the number of teeth on the sprocket that is being used.

**Gear Ratio**

The gear ratio is the relationship between the front chainring and the rear cassette being used. If the chainring and the cog have the same number of teeth the rear wheel would turn once for every pedal stroke and the ratio would be 1 : 1. If the chainring has more teeth than the cog, for example, 34 versus 17, then the ratio would be 2 : 1 and the rear wheel would revolve twice for every pedal stroke. There can also be negative gear ratios where the rear cog has more teeth than the smallest chainring, which makes the rear wheel turn slower than the pedal stroke.



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Front Chainset

Rear Cassette

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Figure 11 Front Chainset and Rear Cassette

Typically, mountain bikes have two or three chainrings in the front and seven to nine cogs in the back. Each of these sprockets is attached to a numerical value, which corresponds to the numbers on the gear-shifting mechanism attached to the handlebars.

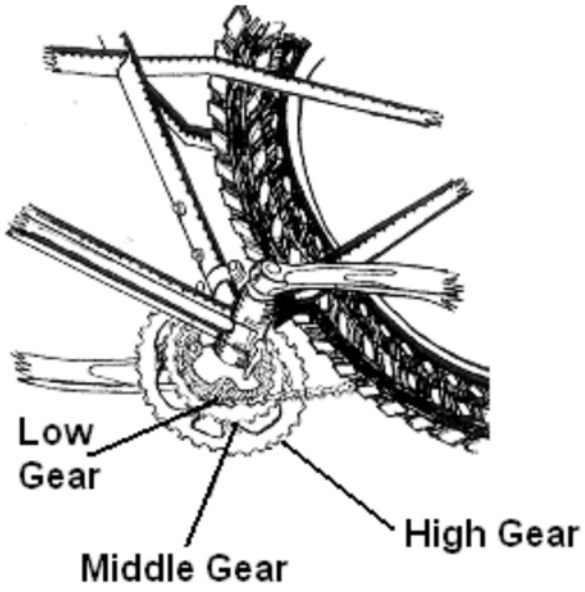
**Chainset**

The chainset is numbered one through three. The biggest chainring in the chainset—three—is located on the outside of the set while the smallest chainring in the chainset—one—is located on the inside of the set.

The biggest chainring in the chainset is used for flat terrain, high speeds, downhill and road pedalling. The middle chainring in the chainset is for most off-road situations including single track, small hills and bumpy downhills. The smallest chainring in the chainset is used for steep uphills and very difficult technical terrain.



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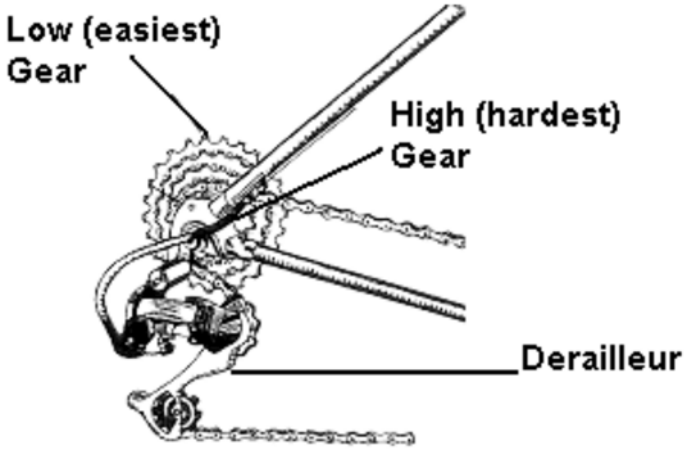



*Note. From Your First Mountain Bike Moves: Shifting Gears by Gorp, 2007, Copyright 2007 by Orbitz Away LLC. Retrieved November 7, 2007, from http://www.gorp.away.com/gorp/publishers/menasha/how_ride5.htm*

Figure 12 Front Chainset

**Cassette**

The cassette is numbered one through nine from the inside, closest to the frame, to the outside. The inside cogs, the larger sprockets, equal the low and easiest gears which are primarily used to climb hills and when traversing uneven terrain. The outside, smaller sprockets, equal the highest and hardest gears which are used to gain speed on flat terrain.




*Note. From Your First Mountain Bike Moves: Shifting Gears by Gorp, 2007, Copyright 2007 by Orbitz Away LLC. Retrieved November 7, 2007, from http://www.gorp.away.com/gorp/publishers/menasha/how_ride5.htm*

Figure 13 Rear Cassette

The mountain bike chain should never be in the big rings on the front and rear at the same time. It places an enormous amount of tension on the chain as it moves the chain from a straight to a diagonal line.



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**Shifting Gears**

As with braking, the left gear shifter controls the chainrings on the front chainset, while the right gear shifter controls the cogs on the rear cassette. When the gear shifter is pushed, the derailleur, front or rear, will move the chain from one sprocket to another.




*Note. From Suspension Mountain Bikes by 2 Wheel Bikes. Retrieved November 7, 2007, from http://www.2wheelbikes.com/suspension-mountainbikes/sm3000-mountain-bike.html*

Figure 14 Right Gear Shifter

All mountain bike gears are indexed, which means they are pre-set and will click into place when the gear lever is activated. Most mountain bikes have a visual indicator on both sides, which shows what gear the mountain bike is in.

Pushing the gear shifter moves the chain onto a bigger chainring or cog, because the movement is against the spring tension in the derailleur. The mountain biker will have to push the lever further than the resting point so that the chain can make it onto the bigger chainring or cog. This is done with the mountain biker's thumb, because it is stronger than the index finger.

Changing to the smaller chainrings or cogs is an easier motion because the lever is releasing the spring tension, letting the derailleur fall naturally into position. These gear changes are completed using the mountain biker’s index finger to pull the lever forward.

It is possible to change more than one gear at a time. This is done through either a series of several clicks or one movement depending on the type of gear shifting mechanism the mountain bike uses.

There are several important points to remember when gearing:

- Gears cannot be changed if the pedals are not moving.
- Cogs are used for small changes in speed, like when the mountain biker is climbing a long steady hill.
- Chainrings are for bigger changes in speed, such as descending the summit of a hill.
- The ideal gear to begin biking is somewhere in the middle of the cassette, four or five, and the middle chainring.

**Ascending Hills**

Climbing hills is a challenge when mountain biking and the mountain bike has been specifically designed to meet this challenge. Its broad, knobby tires, the position of the mountain biker over the back wheel and the increased number of gears give the mountain bike the technical ability to ascend hills.



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A mountain bike can handle inclines close to 45 degrees on badly broken ground.

Being able to ascend a hill is influenced by two factors—balance and power. Balance is gained through awareness and practice, while power is gained through repetition of the skill and muscular and cardiovascular strength.

The following are factors that affect the mountain biker's technique while attempting to ascend a hill.

**Position.** The centre of gravity of a mountain bike and the mountain biker is located at the mountain biker's abdomen. When climbing a hill, the centre of gravity must move forward on the mountain bike to enable the mountain biker to keep their balance. The mountain biker should pull their body weight forward on the mountain bike as the climb gets steeper, otherwise the front tire will not have enough weight on it and will lift up, resulting in a fall.

Centre of gravity is the point where all the weight of an object is concentrated.



*Note. From The Complete Mountain Bike Book (p. 51), by T. Brink, 2007, Camden, ME: Ragged Mountain Press. Copyright 2007 by New Holland Publishers Ltd.*

Figure 15 Proper Ascent Position

While it may seem easier to stand up from the saddle when climbing hills, it in fact requires more power and expends more of the mountain biker's energy. Keeping the body low and forward on the saddle is a much more effective climbing position.

**Gearing and Shifting.** Depending on the steepness of the hill, it is acceptable to have the front chainset on the middle chainring, index two. The rear cassette is more dependent on the grade of the hill. It is advisable, when approaching a hill to begin shifting down into a medium-intensity gear, perhaps four or five. Once the mountain biker has begun the ascent they will have to continue to lower the cogs in relation to their ability to



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maintain pedal power. Remember that in order to change gears, the pedals have to be moving and the more steep the incline, the harder it will be to pedal.

**Descending Hills**

Descending is about letting gravity do the work, while the mountain biker concentrates on braking and distributing weight. It becomes a combination of balance and applying the brakes at the correct time. Riders must always think ahead and be aware of rough terrain, corners, obstacles and other mountain bikers that may be on the trail. It is critical to apply the brakes enough to move around or by disturbances but not too much to avoid completely losing the momentum from the hill.

**Position.** When descending a hill it is critical that the centre of gravity of the mountain biker does not fall more than halfway down the top tube of the mountain bike. If it does, the mountain biker may go over the handlebars. The mountain biker should move their body weight toward the back of the mountain bike, be as low as possible and extend their arms so they are almost straight in front of them. Depending on the steepness of the hill, the mountain biker may want to slide their bottom off and behind the saddle for further stability.



*Note. From Suspension Mountain Bikes by 2 Wheel Bikes. Retrieved November 7, 2007, from http://www.2wheelbikes.com/suspension-mountainbikes/sm3000-mountain-bike.html*

Figure 16 Proper Descent Position

**Gearing and Shifting.** Gearing and shifting are not as critical when descending hills as they are in ascending hills. The key thing to remember is that descending hills provides momentum, and speed must be maintained once the hill has ended. To do this, think ahead and shift into gears that will provide the most momentum. The front chainset should be in the biggest chainring and the rear cassette should be in the highest gear, eight. It may be necessary to shift to lower gears once the momentum from the hill begins to slow and pedalling gets harder.



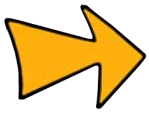
Speed must be controlled when descending hills, with the mountain biker applying equal brake pressure, as required, on both the front and rear brakes. The mountain biker's hands must remain on the brake levers for the duration of the descent and should be ready to brake at all times.



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## DISCUSS MOUNTAIN BIKING ON INTERMEDIATE TRAILS

Mountain bike trails are classified by mountain biking organizations. The mountain biking community has been very persistent in establishing consistent criteria for the rating of all types of mountain bike trails—multi-use, single-use, double track and single track.



The International Mountain Bicycling Association (IMBA) developed a basic method to categorize the technical difficulty of recreation trails. The system was adapted from the International Trail Marking System used at ski areas throughout the world.

The IMBA Trail Difficulty Rating System has been created to:

- help trail users make informed decisions;
- encourage visitors to use trails that match their skill level;
- manage risk and minimize injuries;
- improve the outdoor experience for a wide variety of visitors; and
- aid in the planning of trails and trail systems.

Mountain bike trails, in accordance with the IMBA Trail Difficulty Rating System have been divided into three categories based on trail width, trail surface, trail grade, obstacles and technical features.

The CCM has developed its own rating system that combines similar categories of the IMBA—familiarization trails, intermediate trails and advanced trails.

**Intermediate trails.**Intermediate trails are defined as having some loose surface with minor obstacles such as roots and rocks with a variety of moderate hills that require skills to ascend and descend. Intermediate trails conform to the IMBA category of "More Difficult".

Part of the attraction of mountain biking on intermediate mountain bike trails is the unpredictability of terrain and the obstacles that may be encountered. The following riding considerations should be considered and implemented by the mountain biker when riding on intermediate trails:

- body position,
- speed, and
- control.

### Adopt the Appropriate Body Position

A mountain biker's body position is a key factor to successfully mountain bike on intermediate trails. In most cases, body position is dependent on the successful manipulation of the mountain biker's centre of gravity in relation to the type of terrain being ridden on and the obstacles that are being crossed.



**Centre of gravity.** The point where all the weight of an object is concentrated. The centre of gravity of a bike and the rider is located at the rider's abdomen.



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Have the cadets stand with their feet shoulder width apart, locate their navel (belly button) and lean over like they are riding a mountain bike. Have them move from side to side and front to back in the riding position to see how their balance changes as their centre of gravity shifts locations. They may need a partner for this activity.

Adopting the correct position when mountain biking can mean the difference between getting over an obstacle and falling off the mountain bike. Mountain bikers use a standard 'attack' or 'ready' position when mountain biking and adjust it as required depending on the terrain / obstacle being crossed. The attack or ready position is:

- elbows bent and out,
- head up,
- chin low,
- centre of gravity low, and
- seat hovering over the saddle.

**Regulate Speed**

To successfully traverse the obstacles and varied terrain found on intermediate trails a mountain biker must be able to understand and effectively regulate their speed. Momentum is an ally—without it, riding over rocks / logs / roots / mud would be virtually impossible. Many new mountain bikers, who have low levels of confidence and skill, will slow down as they approach an obstacle—this is due to fear—however, if they keep their speed constant or even a bit faster, they would be able to tackle the obstacle successfully. Speed is controlled by efficient braking and gearing. These two skills are developed through practice and experience.

**Braking.** Understanding the finer nuances of how the brakes—front and rear—work when engaged together is an important facet of riding on intermediate mountain bike trails.

**Gearing.** Gearing is a skill that is driven by each individual mountain biker, depending on skill, physical ability and strength. Knowing personal gear efficiencies is critical when traversing over obstacles and varied terrain.

**Maintain Control**

To ensure safety when mountain biking on intermediate trails, a mountain biker must always be in complete control. Control is maintained by:

- being aware of centre of gravity and adjusting body position accordingly;
- keeping a loose but firm grip of the handle bars; and
- keeping the head up—looking ahead to where the mountain biker wants to go.



Looking up and ahead is one of the hardest skills for mountain bikers to master. At first it feels unnatural, however, looking ahead and not at the ground or object that is being ridden over will ensure success.

**TERRAIN AND OBSTACLES THAT MAY BE ENCOUNTERED ON INTERMEDIATE TRAILS**

Mountain bikers must be aware of the different types of terrain and obstacles they may encounter when riding on intermediate trails because this will ensure they are well prepared to execute the appropriate mountain bike skill in order to ride over / cross that section of terrain or obstacle.



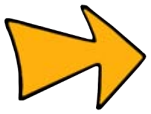
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**TERRAIN**

The *Canadian Oxford Dictionary* defines terrain as ground or a track of land, focusing on its physical characteristics and / or its capacity for use.

The following is a list of the different types of terrain a mountain biker may encounter and be required to travel over when mountain biking on intermediate trails:

- grass,
- mud,
- sand,



As soon as sand becomes more than a couple of centimetres (inches) deep, mountain biking feels like riding in molasses.

- water, and
- gravel.

One of the hardest surfaces to ride a mountain bike across is a grassy meadow without a marked trail. River and stream crossings can be dangerous depending on their depth and should only be crossed at the shallowest point. When crossing, push the mountain bike rather than ride it.

**OBSTACLES**

The *Canadian Oxford Dictionary* defines an obstacle as a person or thing that obstructs progress.

The following is a list of the different obstacles a mountain biker may encounter and be required to travel over when mountain biking on intermediate trails:

- rocks,
- roots,
- logs,
- ruts,
- crevices, and
- potholes.

Dry rocks present few difficulties for mountain bikers—they require skill in order to tackle them effectively without losing momentum—but moss and rain make riding a very unpredictable experience. Wet or mossy rocks remove traction and can turn a wheel in the opposite direction from where the mountain biker intended. Roots are slippery when dry and dangerous when wet.

**MOUNTAIN BIKE ON DIFFERENT TYPES OF TERRAIN**

Part of the attraction of mountain biking on off-road trails is the unpredictability that these types of trails offer. A good mountain bike trail will combine a variety of different types of terrain—grass, mud, sand, water and gravel—that will challenge the mountain biker from start to finish. Many mountain bikers hate to be unseated from their mountain bike and hate to walk their mountain bikes. Knowing the intricacies for mountain biking over different types of terrain will limit the occurrences of such events.



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**GRASS**

Grass is a constantly changing surface that a mountain bike will react differently to depending on if it is new, worn, dry or wet. A mountain biker will have to adapt their riding technique to suit the conditions. On short, dry grass a mountain bike's tires can grip well and the mountain biker will have little difficulty controlling their mountain bike. However, tire grip will be affected as grass becomes worn and / or wet.

Mountain biking on worn or wet grass is difficult, as the tires' ability to grip the ground is diminished. The following considerations should be taken into account:

- stay in the saddle when ascending hills;
- select a medium to low gear to prevent wheel spin;
- brake lightly; and
- be aware of ruts as they will be slippery and may contain water and holes that cannot be seen.

**MUD**

Mud is a type of terrain that mountain bikers look forward to and dread at the same time. Compared to dry trails, mud is harder to mountain bike on / through and requires strong mountain bike skills in order to make the ride more manageable, quicker and enjoyable. Mountain bike tires have significantly less grip / traction when going through mud than when on dry trails. Mud slows down the mountain bikers' speed and momentum and clogs up the gears and brakes.

The following considerations should be kept in mind when mountain biking in mud:

- If possible release some air from the tire; this will provide a larger surface area to grip with.
- Keep all actions as smooth as possible.
- Stay seated in the saddle.
- Move the centre of gravity towards the middle of the mountain bike (over the bottom bracket).
- Shift into a low gear (eg, 1 : 4, 1 : 6, 2 : 3, 2 : 4).



**Bottom bracket.** The bottom bracket is the axel bearing around which the pedals and cranks turn to move the chain.

**SAND**

Sand is an extremely difficult surface to mountain bike on. Sand is common in coastal areas, but can also be found on inland trails. In dry weather, sand can be found on eroded and well-used trails. Sand is a very loose substance and as such provides nothing for the tires to dig into and severely limits traction, affecting momentum. Mountain bikers must ensure they do not sink in the sand or lose speed in order to make it through the section.

The following considerations should be kept in mind when mountain biking on sand:

- When approaching a section of the trail with sand, look for and follow an already established path.
- Approach the sand with a significant amount of speed.
- Keep the weight off the front wheel by moving the centre of gravity towards the middle of the mountain bike (over the bottom bracket).
- Shift into a medium gear (eg, 1 : 6, 2 : 4, 2 : 5).



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- Pedal as smoothly as possible to stop the wheels from spinning.
- Keep the handlebars as straight as possible, using the shoulders and upper body to guide the mountain bike rather than steering it.

**WATER**

There is always a chance that a mountain biker will have to cross some type of water on the trail. Water can be anything from a large puddle to a small creek or stream to a large river. When mountain biking over large rocks covered in water, it is best to aim directly for the stream of water as this will be the cleanest, least slippery section.

The following considerations should be kept in mind when mountain biking through water:

- Approach the water at a medium to high speed to ensure momentum is maintained throughout the crossing.
- Be aware that under the water could be loose and slippery.
- Keep a loose but firm grip on the handlebars—executing smooth controlled movements.
- Move the centre of gravity toward the middle of the mountain bike (over the bottom bracket).
- If the depth of the water is unclear get off the mountain bike and push / carry the mountain bike.

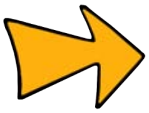


*Note. From Sports, Games, Recreation, Mountain Biking by DK Images, 2008, Copyright 2008 by DK Limited. Retrieved November 20, 2008, from http://www.dkimages.com/discover/Home/Sports-Games-Recreation/Outdoor-Adventure/Mountain-Biking/index.html*

Figure 17 Mountain Biking Through Water



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In some cases, tackling difficult terrain is easier on foot than on the mountain bike. A mountain biker needs to be aware that this is a possibility and make the decision based on their own skill level and the type of terrain that they are crossing.

The following process should be used to shoulder carry a mountain bike:

(1) Stand beside the mountain bike.

(2) Keep the mountain bike steady by putting the left (right) hand on the handlebars.

(3) Bend at the knees and crouch to put the right (left) arm through the frame.

(4) Stand up, with the top tube resting on the right (left) shoulder.

(5) Keep the mountain bike steady by holding either the stem or the handlebars.

(6) Use the opposite arm as a counterweight to balance while walking or running.

**GRAVEL**

Gravel is generally an unpredictable surface to mountain bike on. It usually forms in patches and it is very hard to see and / or determine its depth. The best way to tackle gravel is to avoid it—available alternatives should be taken.



On well-used trails, gravel usually gets pushed to the outside portion of the trail. This allows the mountain biker to avoid the gravel as long as they stay to the middle of the trails.

If a mountain biker must ride through gravel, it is important that they keep movements and actions smooth and controlled—sudden changes in direction and hard braking can cause the wheels to slip and the mountain biker to crash.

**PERFORM ADVANCED MOUNTAIN BIKE SKILLS**

**Falling Off a Mountain Bike**

There is a right and wrong way to fall off a mountain bike. When a person falls their natural instinct is to stick out their arm and try to break the fall. This method does not work and usually causes injury to one or more of the following: thumb, finger, hand, arm, and / or collar bone.

To fall correctly, execute a shoulder roll by:

1. pushing the mountain bike away from the body;
2. tucking the arms and head in towards the chest;
3. hitting the ground with the shoulder first; and
4. rolling over.

**Log Hops**

The most useful skill a mountain biker can have is getting air—being able to lift the wheels off the ground either one or both at a time. Momentum is one of the main reasons a mountain biker would want to lift their front wheel off the ground. Any time the front wheel of the mountain bike hits an obstacle while on the trail, momentum will be lost which will slow down speed.



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Many beginner mountain bikers will attempt to lift the front wheel by simply yanking up with their arms. While this method does work, it is not highly effective as the front wheel will only lift marginally off the ground as there is only a small range of motion before the mountain bikers hands hit their chest.

The process to complete a log hop is as follows:

1. Adopt the attack position.
2. Shift the mountain bike into a medium gear (eg, 2 : 5 or 2 : 6).
3. Pedal toward the obstacle at a medium speed and at a right angle.



It is sometimes difficult for a mountain biker to judge when they should begin to execute a skill such as a log hop. A good rule of thumb is to begin the skill at a distance equal to the obstacles height. For example, if the obstacle is 15 cm (6 inches) high then, the mountain biker should begin to execute the skill approximately 15 cm (6 inches) from the obstacle.

4. Adjust body position, approximately one metre (one yard) away from the obstacle by:
   a. stopping pedalling;
   b. moving the pedals so they are horizontal;



Pedals are horizontal when they are in the 3 o'clock and 9 o'clock position.

   c. sitting down on the saddle; and
   d. shifting the body weight toward the rear of the mountain bike.
5. Lift the front wheel just before reaching the obstacle by:
   a. pedalling one half turn;
   b. compressing the body toward the ground by pushing down on the front fork and front tire;
   c. pushing the hips backwards to shift the centre of gravity;
   d. straightening up and pulling up on the handle bars in one fluid motion, while squeezing the saddle with the inner thighs; and
   e. moving the weight toward the rear wheel to lift up the front wheel.



Step 5 should happen almost simultaneously. Correct timing is critical when attempting to execute a log hop.

6. Place the front wheel on the obstacle.

7. Stand up on the pedals and move the body weight over the handlebars to transfer the centre of gravity from the rear of the mountain bike to the front.



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8. Push forward on the handlebars and allow momentum and pedalling action to roll the mountain bike over the obstacle.

9. Move the body weight toward the rear of the mountain bike as soon as the front wheel hits the ground.

10. Allow the back wheel to roll off the obstacle.

11. Continue mountain biking forward.



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Figure 18 Log Hop

**Cornering**

Cornering is a skill that all mountain bikers will be required to execute on a trail. Mountain bikers will turn corners when riding over grass, on loose gravel, in ruts, on steep downhills or during sharp ascents. Wherever the corner is, it is important to steer the bike around the corner safely and without losing their momentum.

There are three essential elements associated with cornering:

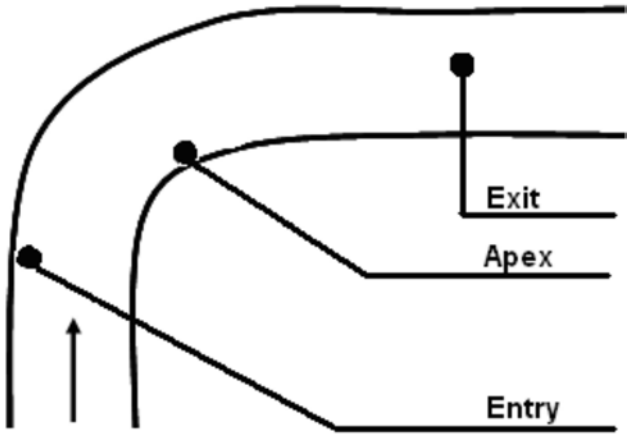
- plotting a line;
- controlling the speed; and
- looking ahead.



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A corner can be divided into three main parts:

- entry,
- apex, and
- exit.




*Note. Created by Director Cadets 3, 2008, Ottawa, ON: Department of National Defence.*

Figure 19 Parts of a Corner

Types of corners:

**Bermed corner.** A bermed corner is also known as a banked corner. The outer perimeter of the corner may be raised too steeply.

**Off-camber corner.** An off-camber corner is the opposite of a bermed corner. The top of the slope is on the inside and slopes down to the outside of the curve.

**Flat turn.** A flat turn is the most common type of corner. There are no raised embankments on either side of the corner.

**Decreasing radius corner.** A decreasing radius corner gets narrower and tighter as it turns. Usually this type of corner is also off-camber.

**Increasing radius corner.** An increasing radius corner gets wider as it turns.

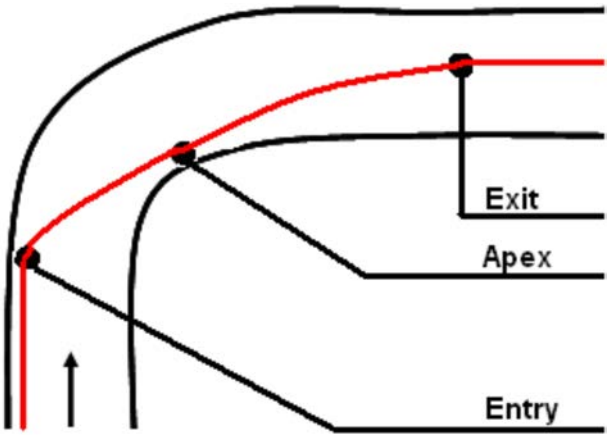
**Plotting a Line**

The standard approach to plotting a line is:

1. Approach the corner on the outside.
2. Shift to the inside at the apex of the corner.
3. Move to the outside to exit the corner.



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*Note. Created by Director Cadets 3, 2008, Ottawa, ON: Department of National Defence.*

Figure 20 Plotting a Line

**Controlling Speed**

When cornering, all the braking should be completed before starting to turn. This is done because it allows the mountain biker to concentrate on exiting the corner. Braking in a straight line is far safer than braking on a corner—a locked rear brake in a corner will slide unpredictably possibly causing a crash.



It is recommended to use the front brakes as much as possible when cornering. It offers more power and control as the mountain biker's weight shifts forward during the turn.

**Looking Ahead**

It is in people's nature to want to look at the obstacle that they are attempting to steer around and try to avoid it. However, when cornering, the mountain biker should look ahead to where the mountain bike is going and ignore the obstacle. This will allow the mountain biker to look further into the corner and allow their mountain bike to follow the line that has already been established.

Use the following process when cornering:

1. Prepare for the corner by:
    a. plotting the line;
    b. engaging the front brakes to slow the mountain bike down; and
    c. shifting into the appropriate gear for the exit, in order to ensure speed is maintained.
2. Execute the corner by:
    a. keeping the fingers over the brake levers, applying them as necessary;
    b. balancing the body between the handlebars and the saddle;
    c. moving the inside pedal to the 12 o'clock position;
    d. pushing the weight of the body onto the outside leg;
    e. bending the inside elbow to pull the body weight forward and inward;



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f. bending the inside knee; and

g. pressing down on the straight outside leg.

3. Pedal once the corner has been turned.



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Figure 21 Body Position When Cornering

**ACTIVITY**

**OBJECTIVE**

The objective of this activity is to have the cadets, in teams of no more than six, mountain bike on familiarization / intermediate trails, for 40–50 km, during an expedition.

**RESOURCES**

- Fully equipped mountain bike (one per cadet),
- Personal mountain bike equipment (one per cadet), and
- Group mountain bike equipment (one per team).

**ACTIVITY LAYOUT**

Designate a familiarization / intermediate mountain bike trail(s), IAW A-CR-CCP-930/AG-001, *Cadet Program Interim Activity Safety Direction*.

**ACTIVITY INSTRUCTIONS**

1. Conduct a briefing to include an explanation of:

   a. the objectives and importance of the activity,

   b. the resources that may be required to perform the activity, and

   c. any safety guidelines that must be followed while performing the activity.



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2. Have the cadets retrieve their mountain bikes and helmets.

3. Have the cadets conduct a pre-ride bike check.

4. Explain and demonstrate the following advanced mountain bike skills, to include:

   a. log hops, and

   b. cornering.

5. Have the cadets, in teams of no more than six, ride a mountain bike on familiarization / intermediate trails, following the designated route during an expedition, to practice:

   a. following road / trail safety regulations;

   b. braking;

   c. shifting gears;

   d. ascending hills;

   e. descending hills;

   f. log hops; and

   g. cornering.

6. Upon arrival at the end point, have the cadets complete a post-ride check and then store / return all equipment.

7. Conduct a debriefing by asking the cadets:

   a. how they felt about the activity;

   b. how they felt their team worked together;

   c. what portion of the activity challenged them the most;

   d. how their teammates assisted them when they were challenged;

   e. if there are any specific examples of when their team bonded;

   f. how the team made decisions;

   g. whether or not all team members ideas / suggestions were considered; and

   h. what they would do as a leader of this type of activity to ensure their subordinates enjoyed the experience.

**SAFETY**

- Each team will be led by the assigned team leader.
- Team Instructor(s) [TIs] must be in sight / sound of the team at all times.
- In areas of complex / technical terrain TI(s) will demonstrate requisite skills as required.
- Teams will travel separately on the same trail.
- There will be a minimum of 500 m between teams at all times.
- Each team will have a cadet positioned at the rear wearing a reflective vest.
- Cadets must travel in single file at all times.



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- Cadets must ensure there are at least two mountain bike lengths between them and the person to their front and rear.
- Cadets must carry at least 1 L of water.
- Water re-supply points will be located along the route.
- Meals will be provided at a pre-determined location(s) and detailed in the route instructions.

**CONFIRMATION OF TEACHING POINT 1**

The cadets' participation in riding a mountain bike will serve as the confirmation of this TP.

**END OF LESSON CONFIRMATION**

The cadets' participation in the activity will serve as the confirmation of this lesson.

**CONCLUSION**

**HOMEWORK / READING / PRACTICE**

Nil.

**METHOD OF EVALUATION**

This lesson is assessed IAW A-CR-CCP-704/PG-001, *Gold Star Qualification Standard and Plan*, Chapter 3, Annex B, 426 PC.

**CLOSING STATEMENT**

Mountain biking is a fun and challenging mode of transport that can be used during expeditions. It is critical to understand the importance of maintaining a mountain bike and riding it safely. Being able to perform mountain bike skills will allow for an enjoyable and safe experience when mountain biking.

**INSTRUCTOR NOTES / REMARKS**

Expedition centres are required to select two dynamic modes of travel from EO M426.02a (Paddle a Canoe), EO M426.02b (Ride a Mountain Bike), EO M426.02c (Hike Along a Route), EO M426.02d (Snowshoe Along a Route) and EO M426.02e (Ski Along a Route) to incorporate into the expedition training.

This EO has been allocated nine periods in the overall course period allocation. Each expedition centre may adjust this allocation to reflect the choice of activities, facilities and available resources at the expedition centre.

Upon arrival at the expedition centre, cadets will be divided into teams. Cadets will be given an opportunity to navigate and lead peers. These teams will remain the same for the duration of the weekend.

IAW A-CR-CCP-930/AG-001, *Cadet Program Interim Activity Safety Direction*:

1. a fully equipped mountain bike is described as having the following:
    a. bell or horn,
    b. lights, and
    c. reflectors;



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2. the following personal mountain bike equipment is required when riding a mountain bike:
    a. helmet,
    b. water carrier,
    c. day pack, and
    d. whistle; and
3. the following group mountain bike equipment is required when riding a mountain bike:
    a. reflective vest (worn by person in rear of group),
    b. topographical / trail map of area as required,
    c. compass,
    d. first aid kit,
    e. communication device (eg, cellular phone or hand-held radio),
    f. GPS receiver, and
    g. mountain bike repair kit, to include:
        (1) spare tube,
        (2) tube patch kit,
        (3) tire levers,
        (4) bike multi-tool, to include:
            (a) 2-, 2.5-, 3-, 4-, 5-, 6- and 8-mm hex keys,
            (b) chain tool,
            (c) flat screwdriver,
            (d) Phillips screwdriver,
            (e) T-25 Torx spoke key,
            (f) spoke wrenches, and
            (g) 8- and 10-mm open wrenches; and
    h. mini pump with gauge.
4. Ensure each cadet has a day pack and an ample supply of water when mountain biking.
5. A mountain bike cleaning kit is comprised of the following items:
    a. bucket,
    b. hand brush,
    c. cleaning cloth,
    d. sponge,
    e. small brush,



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f. stiff brush,

g. dish soap, and

h. lubricant.

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