Musculoskeletal Examination Benchmarks

The approach to examining the musculoskeletal system is the same no matter what joint or limb is being examined. The affected and contralateral region should both be completely exposed and examined, observing for side-to-side differences.

Inspect	Observe alignment and relative sizes of the areas of interest, at rest and in motion
Palpate	Joints
	Soft tissue
	Bursae
	Tendons
	Muscles
	Ligaments
	Bony prominences
Range of motion	Active range of motion
	If active range of motion is abnormal, passive range of motion.
Strength testing	
Directed tests indicated by DDx	Joint specific maneuvers that support or argue against items on the differential diagnosis

As you perform the exam, look for the cardinal signs of musculoskeletal disease:

Swelling: suggests synovial inflammation or joint effusion

Tenderness: suggests inflammation or infection

Warmth: suggests inflammation or infection

Decreased range of motion: suggests one or more of the following

- Intraarticular joint problems causing pain with both active and passive ROM
- Tendon or muscle problems causing weakness or pain with active ROM
- Prolonged disuse of any cause

Weakness: suggests one or more of the following

- Pain causing give-way weakness
- Tendon or muscle problem
- Neurologic problem

Shoulder Exam

Inspect	Anterior and posterior shoulder
Palpate	Start at the sternoclavicular joint and move systematically around the shoulder
	Sternoclavicular joint
	Clavicle
	Acromioclavicular (AC) joint
	Coracoid process: origin of the short head of the biceps
	Biceps tendon in the bicipital groove.
	Subacromial space and rotator cuff: • *supraspinatus* tendon: just below the anterior lateral acromion. • infraspinatus tendon: just below posterolateral acromion. • teres minor: just -inferior to the infraspinatus • subscapularis insertion: just lateral to coracoid at the anterior shoulder
	Spine of the scapula: origin of the infraspinatus
Range of motion	Flexion, also called forward elevation. Normal is 150-170 °
	Abduction. Normal is 180 degrees.
	Rotation. Normal external rotation with the elbows at the side is > 60° and internal rotation in 90° of shoulder abduction is 90°.
Strength Testing	Shoulder abduction
	Flexion/forward elevation
Directed tests based on DDx	Rotator cuff dysfunction: • Painful arc and drop arm test
	AC joint dysfunction: • Scarf or cross-arm test
	Instability/laxity • Apprehension sign

Shoulder: Directed tests

If you suspect rotator cuff dysfunction:

Drop arm and painful arc test: The patient fully abducts the arm and then slowly lowers it to his side.

- A positive drop arm test is the inability to slowly and smoothly lower the arm, which will drop to the side at about 90 degrees. This is a sign of a massive rotator cuff tear.
- A positive painful arc is pain in the shoulder in the midrange of this motion, and is a sign of rotator cuff pathology but not a complete tear.

If you suspect joint instability or laxity:

Apprehension sign: A positive test is that the patient is apprehensive or will not allow the examiner to put the arm in this position. This indicates that the patient has anterior instability with possibility of shoulder dislocation

1. Passively place the patient's arm in 90 degrees of abduction, 90 degrees of elbow flexion, and 90 degrees of external rotation
2. Gently extend the shoulder as you palpate over the anterior shoulder for the humeral head. Increasing apprehension with increasing extension indicates a positive apprehension sign.

If you suspect AC joint arthritis:

Scarf or cross-arm test: A positive test is anterior shoulder discomfort with this movement.

1. The patient brings the arm across the front of body to the opposite shoulder, as if tossing a scarf over the shoulder. This movement is called -adduction.

Shoulder: Tips on technique

- **Palpation of the AC joint** is easier if the patient rotates the arm or brings it across the body.
- **Functional testing of shoulder ROM:**
    1. The patient reaches down behind his head to touch the spine, testing external rotation and abduction. Normal shoulder ROM is to reach down to T1.
    2. Then the patient reaches up behind his back to test internal rotation and adduction. Normal shoulder ROM is to reach up to T10.

Shoulder: Abnormal findings

- **Signs of tendinitis** are tenderness of the tendon pain with resisted motion of the tendon, and pain with passive stretch of the tendon.
- **Supraspinatus atrophy** with decreased muscle mass in the suprascapular fossa, suggests long standing rotator cuff disease. The supraspinatus is the most common rotator cuff muscle to cause problems
- **Decreased ROM in the shoulder**. The most common causes are adhesive capsulitis and glenohumeral joint arthritis.
- **Increased range of motion (laxity).** Common causes are ligamentous laxity or prior shoulder dislocations.

Lumbar Spine Exam for Back Pain

Low back pain is one of the most common reasons that patients visit a physician. More than 80% of people will have low back pain at some point in their lives, and it is the leading cause of disability in people under 40.

Inspect	from the back and the side for normal spine curvature and muscle bulk
Palpate	Begin at L1 and palpate down to the sacrum, observing for tenderness, spasm, and asymmetry:
	• Spinous processes
	• Intervertebral space in the midline
	• Facet joints and paravertebral muscles bilaterally
Range of motion	Forward flexion. Normal is fingers to toes.
Strength and LE neurologic testing	Strength of lower extremity muscles, especially: • Hip flexion and adduction • Knee extension • Ankle dorsiflexion • Big toe extension • Ankle plantar flexion • Big toe dorsiflexion
	Reflexes • Patellar • Achilles • Plantar
	Sensation • Inner thigh • Medial calf and ankle • Dorsum of foot and big toe • Lateral ankle and bottom of foot
	Gait
Directed tests indicated by DDx	Lumbosacral radiculopathy Straight leg raise Crossed straight leg raise

Lumbar Spine: Directed tests

If you are considering nerve root compression from lumbosacral radiculopathy:

Straight leg raise stretches the L5 and S1 nerve roots across a bulging disk or osteophyte complex and can reproduce pain radiating from the back into the foot. The straight leg raise is a sensitive test. If negative, it argues strongly against lumbosacral radiculopathy.

1. With the patient supine, the examiner lifts the leg with the knee straight and ankle dorsiflexed.
2. A positive test is defined as pain in that leg, not just in the back or hip, usually occurring between 30 and 70 degrees of hip flexion.

Crossed straight leg raise. Perform the same maneuver, lifting the asymptomatic leg. A positive test is defined as pain in the leg that is not being lifted, and supports a diagnosis of lumbosacral radiculopathy.

Lumbar spine: Abnormal findings

Vertebral body tenderness suggests compression fracture, infection, or metastatic cancer.

Decreased ROM: Spine range of motion does not correlate with the presence or absence of back pain. Noting which movements reproduce the pain may give you clues to its cause, and observing the quality and amount of movement may tell you about the patient's ability to perform activities of daily life

Lumbosacral radiculopathy is usually caused by a herniated disc. Patients present with back pain and leg symptoms, usually unilateral. The most commonly affected nerve root is L5, followed by S1.
Findings suggesting disc herniation at each level are:

	Pain	**Numbness**	**Weakness**	**Decreased Reflex**
L2 /L3	Back to groin or inner thigh	Inner thigh	Hip flexors and adductors	None
L4	Back to medial thigh, medial ankle and foot	Medial calf and ankle	Quadriceps	Patellar
L5	Back to back of leg, lateral calf, and classically, big toe	Dorsum of foot and big toe	Big toe extension, foot dorsiflexion, thigh abductors	
S1	Back to back of leg, lateral ankle and sole	Lateral ankle and bottom of foot	Plantar flexion and thigh extension	Achilles

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Knee Exam

Inspect	Inspect the knee in the standing position, observing alignment and leg length.
	Observe gait.
	Inspect the knee in the seated or supine position, observing for deformity, swelling, erythema, ecchymoses.
Palpate	Palpate systematically, noting warmth, deformity, swelling and tenderness:
	• Patella, quadriceps tendon and prepatellar bursa
	• Proximal tibia—including tibial plateau area, patellar tendon, tibial tuberosity and Gerdy's tubercle.
	• Proximal fibula (apex (?), head, and neck)
	• Medial & lateral femoral epicondyles
	• Popliteal fossa. Joint Line: medial & lateral.
Range of Motion	Extension. Normal is 0 degrees.
	Flexion. Normal is 135 degrees.
Strength testing	Knee extension, testing quadriceps strength (seated) in knee extension
	Knee flexion, testing hamstring strength (seated) in knee flexion
Directed tests based on DDx	Medial (MCL) or lateral (LCL) cruciate ligament injury: • Test MCL and LCL stability, with valgus and varus stresses
	Anterior Cruciate Ligament (ACL) tear • Anterior Drawer test , in 90deg of knee flexion: • Lachman's test, in 20-30 deg of knee flexion:
	Posterior Cruciate Ligament (PCL) tear • Posterior drawer test , in 90 deg of knee flexion
	Meniscal injury • McMurray's Test, lying supine
	Assess for joint effusion

Knee: Directed tests

If you suspect Medial or Lateral Collateral Ligament injury (MCL and LCL)

1. The patient lies supine, with the thigh abducted 30 degrees and resting on the edge of the table. Support the lower leg as it hangs over the edge.
2. Stabilize the thigh by placing your hand firmly on the lower thigh just above the knee
3. Valgus stress to test MCL stability: Pull the foot outward with your other hand (valgus stress), first with the knee flexed at 15 degrees, then with the knee extended. Note joint laxity, the firmness of the endpoint of movement, and any pain.
4. Varus stress to test LCL stability: Now pull the foot inward (varus stress), with the knee flexed to about 15 degrees, then with the knee extended.
   [I suggest doing these tests with the knees in full extension first, to test for capsular integrity. Then with 15-20 deg of knee flexion, repeat these tests to test the collateral ligaments.
   Also, I do these tests witht he limb tucked under my arm, and both hands supporting the knee with thumbs on the joint line. I can feel the opening to stress much more precisely with this method.]

If you suspect Anterior Cruciate Ligament tear (ACL)

Perform either the anterior drawer or Lachman's test. Lachman's test has better sensitivity and specificity. The anterior drawer is easier for examiners with small hands.

Anterior Drawer test:

1. With the patient supine, bend the knee to 90 degrees. Sit gently on the foot to stabilize it. Make sure the hamstrings are relaxed.
2. Cup your hands around the proximal tibia with fingers on the lateral & medial joint line
3. Pull forward slowly but firmly, noting the amount of anterior movement of the tibial plateau on the femoral condyles and the firmness of the endpoint.

Lachman's test:

1. With the patient supine, bend the knee to 20-30 degrees
2. Support the distal thigh with your hand, with your thumb on the anterior thigh, making sure the hamstrings are relaxed.
3. Hold the upper tibia with the other hand, your thumb on the anterior shin
4. Pull the upper tibia forward, slowly but firmly, while holding the femurstill with your other hand. Again, note the degree of forward excursion of the tibial plateau on the femoral condyles and the firmness of the endpoint

If you suspect Posterior Cruciate Ligament (PCL) tear

Posterior Drawer test: (typically performed right after the anterior drawer test)

1. With patient supine, bend the knee to 90 degrees & sit gently on the foot to stabilize.Warn the patient first that you are going to gently sit on the end of their foot!
2. Cup your hands around the upper tibia with thumbs on the lateral and medial joint line
3. Push back slowly but firmly on the tibia, noting the amount of posterior movement of the tibial plateau on the femoral condyles and the firmness of the endpoint.

If you suspect meniscal injury

McMurray's Test:

1. With the patient supine, stand on the side of the affected leg. Cradle the heel in one hand with the foot resting on your arm, and place the fingers and thumb of the other hand on the medial and lateral joint line.
2. To test the medial meniscus: Fully flex the knee, externally rotate the foot and lower leg (toes point away from midline), and extend the leg. A positive test is defined as pain or clicking or popping at the joint line
3. To test the lateral meniscus: Fully flex the knee, internally rotate the foot and lower leg (toes point toward midline), and extend the leg. You will move the heel through a "U" shape, as you flex, extend and rotate the leg. A positive test is defined as pain or clicking or popping at the joint line.

If you suspect knee effusion

Evaluate for knee effusion with the patient supine and the knee extended. There are many ways to do this. One method is:

1. With your left hand, compress the suprapatellar pouch against the femur, pushing any fluid in that space into the knee joint. With your right hand, 'milk' any fluid out of the medial knee. Then push on the lateral knee, observing for a fluid bulge medially.

Other abnormal findings:

- **Atrophy of the extensor muscles**, especially v. medialis, is common in chronic knee pain
- **Joint crepitus** is a popping or grinding on palpation when a joint is moved. This may come from abnormal cartilage, tendons, or bone grinding on bone.