Question 1: All blue numbers are measured in Kilograms. Note: “20N Mass” should be “20N Weight”

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| **Q1.m** |
| close all;    im1 = imread('Abduction30.png');  im2 = imread('Abduction60.png');  im3 = imread('Abduction90.png');  im4 = imread('Abduction120.png');    imcenter = [130 107;  164 129;  197 84;  171 88];    abductionAngle = [30 60 90 120];  massHeld = [0 20/9.81];    for i = 1:2  for j = 1:4  disp(['Forces for abduction angle of ' num2str(abductionAngle(j)) ' degrees']);  % weight, height, massHeld, armAngle, armCOMtoFdeltAngle, FdeltDistToJoint  [Fdelt, Fjx, Fjy, angle] =...  ShoulderForces(77, 190, massHeld(i), abductionAngle(j), 7.5, 7.5);    figure;  %subplot(2, 4, j+4\*(i-1));  switch j  case 1  imshow(im1); hold;  case 2  imshow(im2); hold;  case 3  imshow(im3); hold;  case 4  imshow(im4); hold;  end    if (i == 1)  title('No Mass');  else  title('20N Mass');  end    arrow(imcenter(j, :)-[Fjx Fjy]/norm([Fjx, Fjy])\*100, imcenter(j, :),...  'EdgeColor', 'r', 'FaceColor', 'r');  text(imcenter(j,1)+10, imcenter(j,2)+10, num2str(norm([Fjx, Fjy])), 'color', 'b');    disp(' ');  end  end |
| **ShoulderForces.m** |
| function [ Fdelta, Fjx, Fjy, angle ] = ShoulderForces( weight, height,...  massHeld, armAngle, armCOMtoFdeltAngle, FdeltDistToJoint)    format compact  syms Fdelta;    %weight = 77; % kg  %height = 190; % cm    armLength = (0.818 - 0.377)\*height  armCOM = 0.53 \* armLength  armSegmentWeight = 0.05\*weight    %armAngle = 30 % degrees    armMomentAngle = 90-armAngle  %armCOMtoFdeltAngle = 7.5    paperToBodyRatio = 3    % sum of moments to solve for fDelta;  syms Fdelt;    jointToFdeltLength = FdeltDistToJoint/10\*paperToBodyRatio % cm    moments = (0 == Fdelt\*jointToFdeltLength -...  (armSegmentWeight\*cos(degtorad(armMomentAngle))\*armCOM + ...  massHeld\*cos(degtorad(armMomentAngle))\*armLength));    Fdelt = double(solve(moments))    Fjy = (armSegmentWeight+massHeld) - Fdelt\*cos(degtorad(armAngle - armCOMtoFdeltAngle))  Fjx = -Fdelt\*sin(degtorad(armAngle - armCOMtoFdeltAngle))    angle = radtodeg(atan2(Fjy, Fjx));  if (angle < 0)  angle = 360 + angle;  end  angle    end |

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| **Output** | | |
| **Abduction Angle** | **No Mass** | **20N Weight** |
| 30 | Fdelt =  37.9941  Fjy =  -31.2520  Fjx =  -14.5397  angle =  245.0502 | Fdelt =  75.9554  Fjy =  -64.2849  Fjx =  -29.0669  angle =  245.6696 |
| 60 | Fdelt =  65.8077  Fjy =  -36.2112  Fjx =  -52.2088  angle =  214.7446 | Fdelt =  131.5586  Fjy =  -74.1990  Fjx =  -104.3724  angle =  215.4093 |
| 90 | Fdelt =  75.9882  Fjy =  -6.0685  Fjx =  -75.3381  angle =  184.6052 | Fdelt =  151.9107  Fjy =  -13.9396  Fjx =  -150.6111  angle =  185.2879 |
| 120 | Fdelt =  65.8077  Fjy =  29.0335  Fjx =  -60.7984  angle =  154.4738 | Fdelt =  131.5586  Fjy =  56.2340  Fjx =  -121.5443  angle =  155.1718 |

The paper *In Vivo Hip Joint Loading during Post-Operative Physiotherapeutic Exercises* seeks to establish whether post-surgery physiotherapy exercises pose a threat to the healing process.