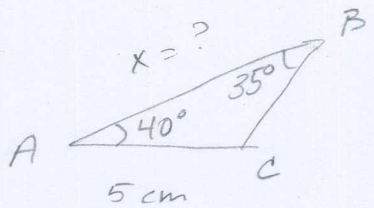
Practice Test Chapter 9
Math 144

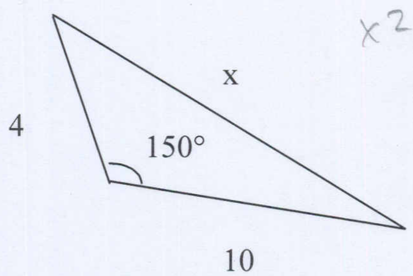
1. In Δ ABC, ∠A = 40°, ∠B = 35°, and AC = 5 cm. Find the length of side AB in cm.



$C = 180 - [40+35] = 105°$

$\dfrac{x}{\sin 105°} = \dfrac{5}{\sin 35°} \Rightarrow \boxed{x = 8.42}$

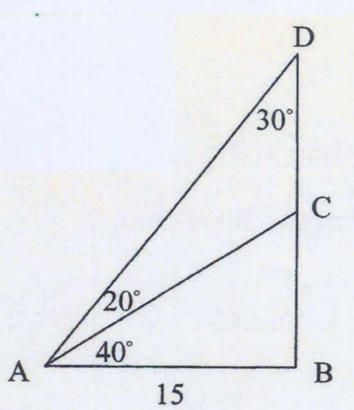
2. Determine x in the triangle shown.



$x^2 = 4^2 + 10^2 - 2(4)(10)\cos 150° = 185.3$

$x = \sqrt{185.3} = \boxed{13.6}$

3. Determine CD in the figure shown to the right. Angle ABC is a right angle.



$\cos \theta = \dfrac{adj}{hyp}$

AD

$hyp = \dfrac{15}{\cos 60°} = 30 \rightarrow \overline{AD}$

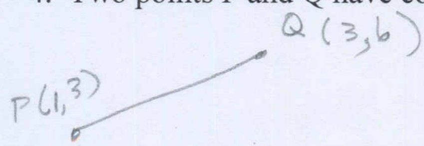
$30 \sin 60° = \overset{BD}{opp} = 25.98 \rightarrow \overline{BD}$

$\tan \theta = \dfrac{opp}{adj} \Rightarrow \tan 40° = \dfrac{BC}{15} \Rightarrow \overline{BC} = 12.586$

$\overline{CD} = \overline{BD} - \overline{BC}$

$\overline{CD} = 25.98 - 12.586 = \boxed{13.4}$

4. Two points P and Q have coordinates P (1, 3) and Q (3, 6). Find the magnitude of **PQ**.

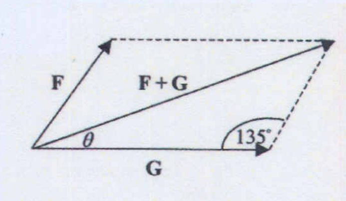


$\overline{PQ} = (x_2 - x_1) + (y_2 - y_1)$

$= (3-1) + (6-3)$

$\overline{PQ} = \langle 2, 3 \rangle \Rightarrow |\overline{PQ}| = \sqrt{2^2 + 3^2} = \boxed{3.6}$

5. Two forces **F** and **G** act on an object as shown. **F** = 8 N and **G** = 20 N. Find the magnitude of **F** + **G**.

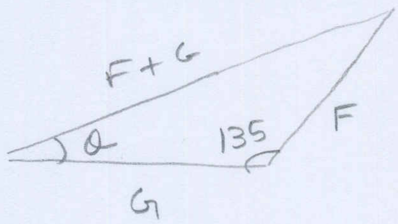


$(F+G)^2 = 20^2 + 8^2 - 2(20)(8)\cos 135^\circ$

$= 690.27$

$F+G = \sqrt{690.27} = \boxed{26.27}$

7. Referring to the figure in #5, find the angle θ (in degrees) between the forces **G** and **F+G**.

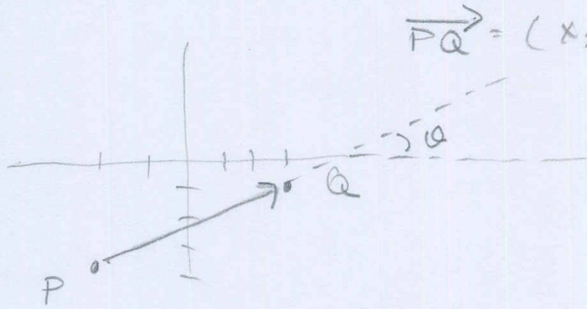


$\frac{\sin\theta}{F} = \frac{\sin 135}{F+G} = \frac{\sin\theta}{8} = \frac{\sin 135}{26.27}$

$\sin\theta = 0.2153$

$\theta = \sin^{-1}(0.2153) \Rightarrow \boxed{\theta = 12.44^\circ}$

8. The coordinates of two points P and Q are given by P (-2, -4) and Q (3, -1). Determine the angle θ (in degrees) between the vector **PQ** and the *positive* x-axis.



$\overrightarrow{PQ} = (x_2 - x_1) + (y_2 - y_1) = (3-(-2)) + (-1-(-4))$

$= \langle 5 + 3 \rangle$

$= \langle 5, 3 \rangle$

$\tan\theta = \frac{opp}{adj} = \frac{3}{5}$

$\theta = \tan^{-1}\left(\frac{3}{5}\right) = \boxed{30.96^\circ}$

9. If **a** = 2x + 6y and **b** = -1x + 4y, find the vector 2**a** – 3**b**.

$\vec{a} = 2(2+6) = 4, +12$

$\vec{b} = 3(-1+4) = -3, +12$

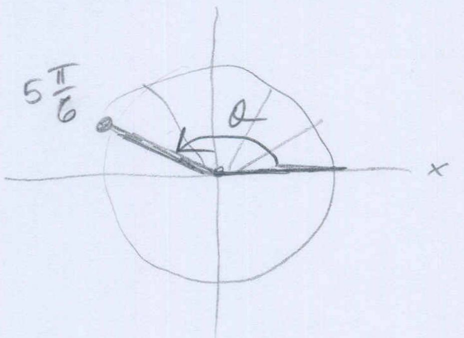
$2\vec{A} - 3\vec{b} = \langle 4 + 12 \rangle - \langle -3 + 12 \rangle$

$(4-(-3)) + (12-12)$

$7 + 0$

$\boxed{= \langle 7, 0 \rangle}$

10. The angle between a vector **v** and the positive x-axis is 5π / 6. The magnitude of **v** is 5. Determine the components of **v**.



$\cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}$ in Quad II so $-\frac{\sqrt{3}}{2}$ these are for reference angle

$\sin \frac{\pi}{6} = \frac{1}{2}$ in Quad II $\frac{1}{2}$

$|v| = 5 \Rightarrow 5\left(-\frac{3}{2}\right) + 5\left(\frac{1}{2}\right)$ ← reference angle

to find angle from positive x-axis, use complimentary angle: switch sin & cosine

$\boxed{-\left\langle -\frac{5}{2}, \frac{5\sqrt{3}}{2} \right\rangle}$

11. Find a vector **u** having a length of 1 and the same directions as **v** = [-4 +3].

$|v| = \sqrt{-4^2 + 3^2} = 5$

divide components by magnitude for unit vector (= magnitude of 1)

$\boxed{\left\langle \frac{-4}{5}, \frac{3}{5} \right\rangle}$

12. If **a** = [2 + 3] and **b** = [-2 +5] compute |b| **a** + |a| **b**

$|a| = \sqrt{2^2 + 3^2} = \sqrt{13}$

$|b| = \sqrt{-2^2 + 5^2} = \sqrt{29}$

$\sqrt{29}(2 + 3) + \sqrt{13}(-2 + 5)$

$\boxed{\left\langle 2\sqrt{29} + 3\sqrt{29}, -2\sqrt{13} + 5\sqrt{13} \right\rangle}$

13. Express the vector 2[1 – 2] + 3[4 -1] in terms of the unit vectors **i** and **j**.

$\langle 2 - 4 \rangle + \langle 12 - 3 \rangle$

$(12 + 2) + ((-3) + (-4))$

$14 + 7$

$\boxed{= 14i - 7j}$

14. A curve is given parametrically by the equations x = 1+ t^2 and y = 2 – t^3. Determine the coordinates of the point on the curve when t = 2.

$x = 1 + 2^2 = 5$

$y = 2 - 2^3 = -6$

$\boxed{P(5, -6)}$

15. A curve is given parametrically by the equations x = 2 – 3t and y = 2 + $3t^2$. If P(x, y) is a point on the curve with x = 1, determine y.

from x-eqn: $3t = 2 - x$

$t = \frac{2-x}{3}$

substitute into y equation

$y = 2 + 3\left[\frac{2-x}{3}\right]^2$

when $x = 1$:

$y = 2 + 3\left[\frac{2-1}{3}\right]^2 = \boxed{\frac{7}{3}}$

the math steps: $y = 2 + 3\left(\frac{1}{3}\right)^2$

$2 + 3\left(\frac{1}{9}\right) = 2 + \frac{3}{9} = \frac{3}{3}(2) + \frac{1}{3} = \frac{6}{3} + \frac{1}{3} = \frac{7}{3}$

17. The position of a point P (x,y) at time *t* is given by the parametric equations x = 2 sin *t* and y = 3 cos *t*. Find the x-y equation for the path traced out by the point P.

$x = 2\sin t$ $\quad y = 3\cos t$ $\quad$ remember: $\sin^2 t + \cos^2 t = 1$

$\frac{x}{2} = \sin t$ $\quad \frac{y}{3} = \cos t$

$\left(\frac{x}{2}\right)^2 + \left(\frac{y}{3}\right)^2 = \sin^2 t + \cos^2 t$

$\boxed{\frac{x^2}{4} + \frac{y^2}{9} = 1}$