

Section 2: Moments of forces at an angle

Solutions to Exercise level 1

1. (i) Taking moments about A with the clockwise direction as positive
 $4 \times 1.2 \sin 60^\circ - 4 \times 1.6 = -2.24 \text{ Nm (3 s.f.) clockwise}$
 This is 2.24 Nm anticlockwise
- (ii) Taking moments about A with the clockwise direction as positive
 $5 \times 1.8 \sin 60^\circ - 8 \times 2.4 \sin 30^\circ = -1.81 \text{ (3 s.f.) clockwise}$
 This is 1.81 Nm anticlockwise
- (iii) Taking moments about A with the clockwise direction as positive
 $6 \times 2 \sin 32^\circ - 4 \times 4 \cos 32^\circ = -7.21 \text{ Nm (3 s.f.) clockwise}$
- (iv) Taking moments about A with the clockwise direction as positive
 $5 \times 4 + 4 \times 3 - 6 \times 1 = 26 \text{ Nm clockwise}$
- (The non-90° angles given here were not needed for the calculation.)
- (v) Taking moments about A with the clockwise direction as positive
 $5 \times 1 \sin 60^\circ - 4 \times 5 \cos 40^\circ - 5 \times 4 \sin 20^\circ = -17.8 \text{ Nm (3 s.f.) clockwise}$
 This is 17.8 Nm anticlockwise
2. (i) Taking moments about A with the clockwise direction as positive
 $8g \times 2 \sin 60^\circ - 4F = 0$
 $F = 40 \sin 60^\circ$
 $F = 20\sqrt{3} \text{ N or } F = 34.6 \text{ N (3 s.f.)}$
- (ii) Taking moments about A with the clockwise direction as positive
 $8g \times 2 \sin 70^\circ - 4 \sin 40^\circ F = 0$
 $F = \frac{160 \sin 70^\circ}{4 \sin 40^\circ}$
 $F = 58.5 \text{ N (3 s.f.)}$
- (iii) Taking moments about A with the clockwise direction as positive
 $8g \times 2 \sin 10^\circ - 4 \sin 30^\circ F = 0$
 $F = \frac{160 \sin 10^\circ}{4 \sin 30^\circ}$
 $F = 78.8 \text{ N (3 s.f.)}$

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(iv) Taking moments about A with the clockwise direction as positive

$$8g \times 2 \cos 30^\circ - 1 \sin 60^\circ F = 0$$

$$F = \frac{160 \cos 30^\circ}{\sin 60^\circ}$$

$$F = 160 \text{ N}$$