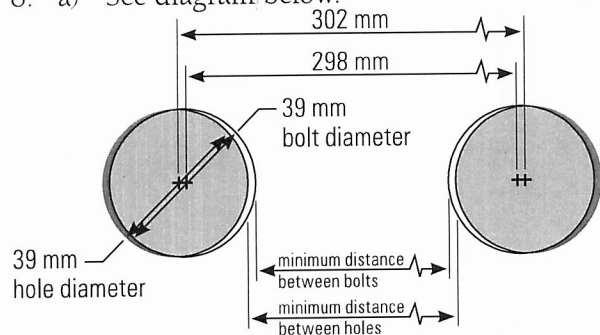


Extend Your Thinking

8. a) See diagram below.

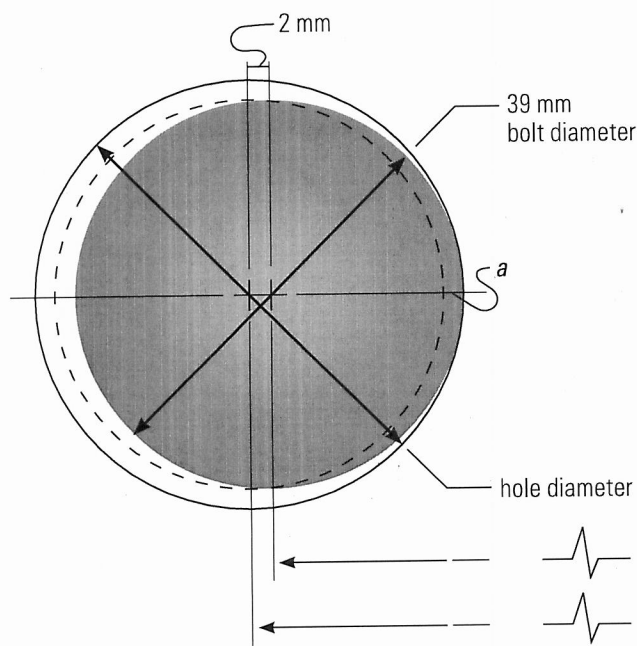


Distance between inner edges of bolts = 259 mm

Distance between inner edges of holes = 263 mm

The plate will not fit over the holes because the bolts will interfere with the inner edges of the holes.

b) See diagram below.



The bolt holes should be at least 43 mm in diameter to make sure they fit over the bolts.

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1. a) precision = 5 km/h
uncertainty = ± 2.5 km/h
speed = 65 km/h ± 2.5 km/h
- b) precision = 0.01 V
uncertainty = ± 0.005 V
voltage = 11.54 ± 0.005 V
- c) precision = 10 psi
uncertainty = ± 5 psi
pressure = 90 psi ± 5 psi

2. Answers will vary.

3. a)

THERMOCOUPLE READINGS			
Temp. (°C)	Voltage (mV)	Voltage (mV) to 2 decimal places	Voltage (mV) to 1 decimal place
100	4.096	4.10	4.1
101	4.138	4.14	4.1
102	4.179	4.18	4.2
103	4.220	4.22	4.2
104	4.262	4.26	4.3
105	4.303	4.30	4.3
106	4.344	4.34	4.3
107	4.385	4.39	4.4
108	4.427	4.43	4.4
109	4.468	4.47	4.5
110	4.509	4.51	4.5

b) The voltmeter must read at least to the nearest 0.01 mV.

c) It would be precise enough to resolve a 1°C temperature difference.

4. a) 335.9 cm ± 0.2 cm
- b) 1.115 L ± 0.010 L
- c) 46 m ± 3 m

5. a) precision = 0.01 s
 uncertainty = ± 0.005 s
- b) $2:33.06 \pm 0:00.01$
- c) The first-place finisher's time was $2:29.26 \pm 0:00.01$.
 Jacob and the winner could have been separated by as little as 3.78 s.
6. 0.403 ± 0.0015 inches
7. No; the change in volume is much smaller than the precision and uncertainty of the bucket measurement. She will still read 10 L on the bucket scale.
8. 2.1165 ± 0.0005 inches
9. a) dimensional variation = $\pm \frac{5}{64}$ in
 b) dimensional variation = $\pm \frac{1}{24}$ in

10. a)

WIDTH ACROSS FLATS OF STANDARD HEX NUTS			
<i>Basic size</i>	<i>Max. dimension (in)</i>	<i>Min. dimension (in)</i>	<i>Tolerance (max - min)</i>
$\frac{11}{32}$	0.344	0.332	0.012
$\frac{3}{8}$	0.375	0.362	0.013
$\frac{7}{16}$	0.438	0.428	0.010
$\frac{1}{2}$	0.500	0.489	0.011
$\frac{9}{16}$	0.562	0.551	0.011
$\frac{11}{16}$	0.688	0.675	0.013
$\frac{3}{4}$	0.750	0.736	0.014
$\frac{7}{8}$	0.875	0.861	0.014
$\frac{15}{16}$	0.938	0.922	0.016
$1\frac{1}{8}$	1.125	1.088	0.037
$1\frac{5}{16}$	1.312	1.269	0.043
$1\frac{1}{2}$	1.500	1.450	0.050

- b) The basic dimension (nominal size) is the maximum dimension.
- c) The hex nuts must fit standard wrench sets. If they are oversized, they will not fit the proper wrench size.
- d) If the nut is undersized, it will not be strong enough to withstand the tightening forces on the bolt.
- e) precision = 0.001"