

## Number Trial #2:

### Prison Teachers

You are asked to help estimate the requirements of the Prison Service in helping New Zealand's prison population obtain qualifications.

---

#### Numbers

There were 6,780 people in prison as a result of a conviction in NZ in December 2011.

The number of people sentenced and in prison is expected to grow by 2% in 2012.

Three quarters of the people in prison in NZ left school with no qualifications.

There is one female prisoner for every 18 male prisoners.

Females are in separate prisons, so require separate teachers.

60% of prisoners are in prison long enough to be worth starting training.

One teacher is required for every 40 prisoners.

---

#### Task 1:

Predict the amount of men and women without qualifications in NZ's jails in 2012.

From that predict the amount of teachers required.

---

#### Task 2:

The predicted trend in prison population for the decade after 2012 is

Female prisoners will increase by about 1% per year

Male prisoners will fall by about 2% per year.

Use this information to predict the prison population in 2022, and the amount of teachers required.

Discuss any mathematical problems with your analysis.

## Answers: Number Trial #2:

**Task 1:** Predict the amount of men and women without qualifications in 2012. From that predict the amount of teachers required.

There were 6,780 people in prison as a result of a conviction in NZ in December 2011. The number of people sentenced and in prison is expected to grow by 2% in 2012.

$$2\% \text{ is } \frac{2}{100} \times 6780 = 135.6. \text{ Add to } 6,780 \text{ and round} = 6,916 \text{ people by } 2012 \quad \boxed{A}$$

Three quarters of the people in prison in NZ left school with no qualifications.

$$\frac{3}{4} \text{ of } 6,916 \text{ is } \frac{3}{4} \times 6,916 = 5187 \text{ with no qualifications} \quad \boxed{A}$$

There is one female prisoner for every 18 male prisoners.

$$1 : 18, \text{ means one woman for every } 1 + 18 = 19 \text{ people.}$$

$$5187 \div 19 = 273 \text{ female, and } 4,914 \text{ male prisoners without qualifications} \quad \boxed{A}$$

60% of prisoners are in prison long enough to be worth starting training.

$$60\% \text{ is } \frac{60}{100} \times 273 = 164 \text{ females}$$

$$60\% \text{ is } \frac{60}{100} \times 4,914 = 2,948 \text{ males} \quad \boxed{A}$$

One teacher is required for every 40 prisoners.

$$164 \div 40 = 4.1 \text{ teachers for females. Can probably round down to } 4.$$

$$2,948 \div 40 = 73.7 \text{ teachers for males. Round up to } 74. \quad \boxed{A}$$

**Answer = about 78 teachers.**

---

**Task 2:** predict the prison population in 2022, and the amount of teachers required.

Female prisoners will increase by about 1% per year

$$164 \text{ females increasing by } 1\% \text{ per year for } 10 \text{ years} = 164 \times \left(\frac{101}{100}\right)^{10} = 181$$

Male prisoners will fall by about 2% per year.

$$2948 \text{ males decreasing by } 2\% \text{ per year for } 10 \text{ years} = 2948 \times \left(\frac{98}{100}\right)^{10} = 2,409$$

$$1 \text{ teacher per } 40 = 4.5 \text{ for females and } 60.2 \text{ for males} = \mathbf{65 \text{ teachers by } 2012} \quad \boxed{M}$$

### Problems:

1. If the projected % change is out a bit it can have a large effect over time.  
If for men it actually drops by 2.5% each year, then  $2948 \times \left(\frac{97.5}{100}\right)^{10} = 2,289$   
So small error – ½% – over time leads to 120 prisoners = 3 teachers wrong.
2. The rounding above assumes that all the prisoners are in one place. Since the prisons are spread out, they will need to be rounded separately.

**3 different A skills = Achieved. Merit requires answer with only one mistake. Excellence requires correct rounding and some assessment of likely errors.**