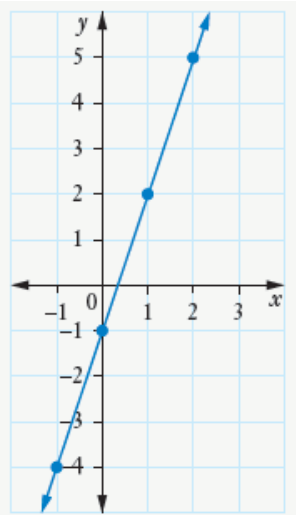
NEW CENTURY MATHS 11
MATHEMATICS STANDARD (PATHWAY 2)

FULLY WORKED SOLUTIONS

Chapter 7

SkillCheck

Question 1



Question 2

a

x	–1	0	1	2
y	5	7	9	11

b

x	–1	0	1	2
y	–3	–4	–5	–6

Question 3

$y = mx + c$

$5 = 3 \times 2 + c$

$5 = 6 + c$

$c = -1$

Question 4

a

$y = kx$

$= 0.7 \times 4$

$= 2.8$

b

$y = kx$

$10 = k \times 2.5$

$k = \frac{10}{2.5}$

$= 4$

Question 5

a **i**

$V = -450 \times 3 + 2575$

$= 1225$

ii

$V = -450 \times 4.2 + 2575$

$= 685$

b **i**

$1450 = -450t + 2575$

$-1125 = -450t$

$t = \frac{-1125}{-450}$

$= 2.5$

ii

$10 = -450t + 2575$

$-2565 = -450t$

$t = \frac{-2565}{-450}$

$t = 5.7$

Exercise 7.01 Graphing linear functions

Question 1

Using $y = mx + c$:

a $y = 3x + 7$

b $y = -2x + 1$

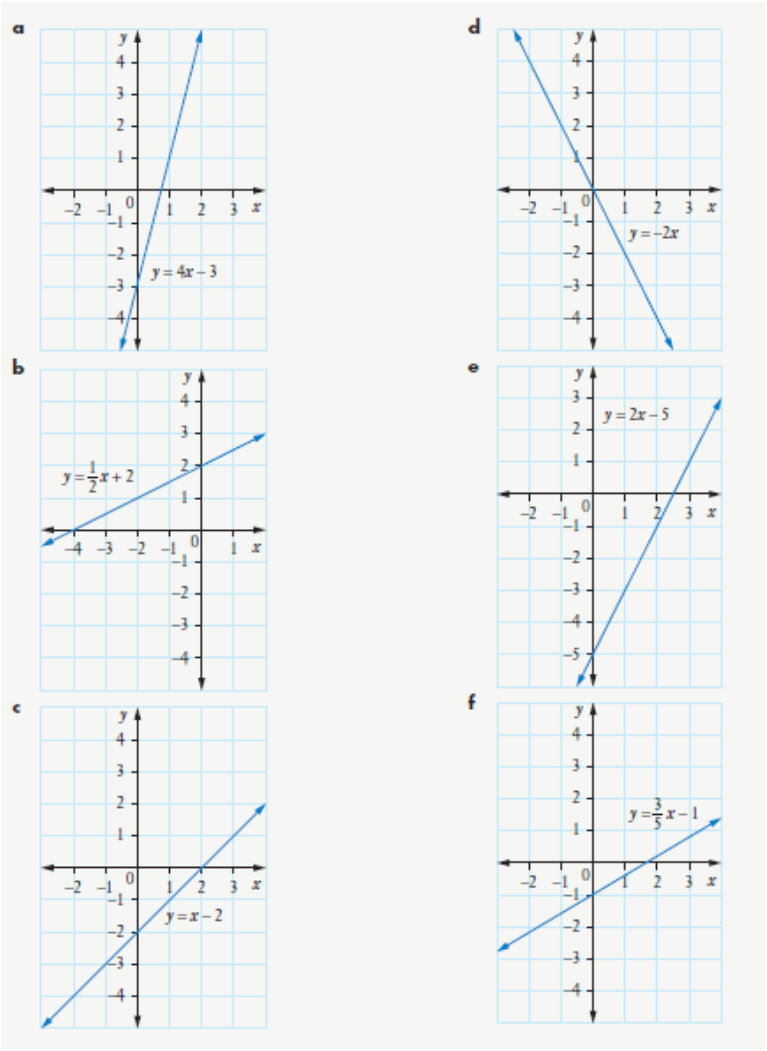
c $y = x - 1$

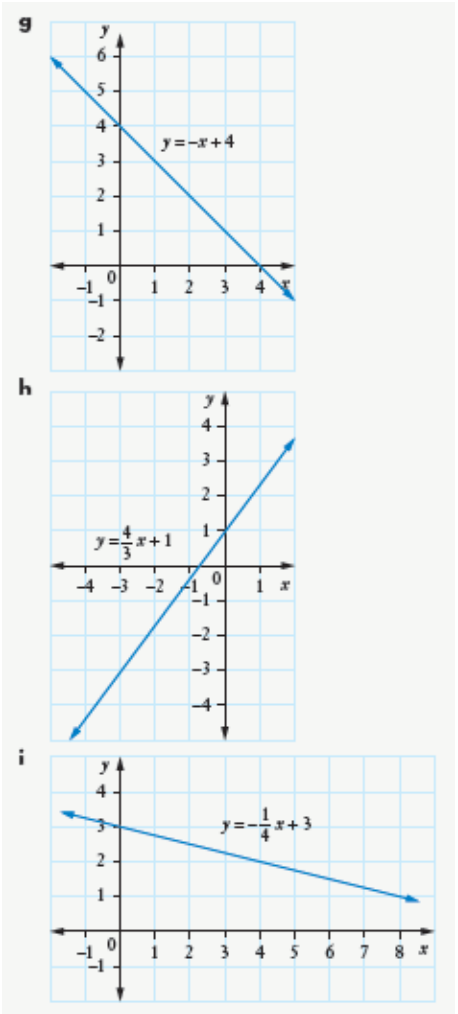
d $y = \frac{1}{3}x - \frac{1}{2}$

e $y = -\frac{5}{4}x$

f $y = 5$

Question 2





Question 3

$m = 3$

$\therefore D$

Question 4

a $m = \dfrac{3-(-1)}{0-(-2)} = \dfrac{4}{2} = 2$

$c = 3$

$\therefore y = 2x + 3$

b $m = \dfrac{2-(-1)}{1-0} = \dfrac{3}{1} = 3$

$c = -1$

$\therefore y = 3x - 1$

c $m = \dfrac{4-0}{1-0} = \dfrac{4}{1} = 4$

$c = 0$

$\therefore y = 4x$

d $m = -2$

$c = 2$

$\therefore y = -2x + 2$

e $m = \dfrac{0-1}{1-0} = \dfrac{-1}{1} = -1$

$c = 1$

$\therefore y = -x + 1$

f $m = 2 - 0 = \dfrac{1}{2}$

$c = -1$

$\therefore y = \dfrac{1}{2}x - 1$

g $m = \dfrac{-1-1}{1-(-1)} = \dfrac{-2}{2} = -1$

$c = 0$

$\therefore y = -x$

h $m = \dfrac{1-(-2)}{4-0} = \dfrac{3}{4}$

$c = -2$

$\therefore y = \dfrac{3}{4}x - 2$

i $m = \dfrac{0-(-3)}{3-0} = \dfrac{3}{3} = 1$

$c = -3$

$\therefore y = x - 3$

Exercise 7.02 The gradient formula

Question 1

a $\frac{5-1}{4-2}=\frac{4}{2}=2$

b $\frac{0-2}{2-0}=\frac{-2}{2}=-1$

c $\frac{15-3}{11-5}=\frac{12}{6}=2$

d $\frac{6-8}{10-6}=\frac{-2}{4}=-\frac{1}{2}$

e $\frac{9-2}{9-4}=\frac{7}{5}$

f $\frac{4-19}{14-11}=\frac{-15}{3}=-5$

g $\frac{6-3}{4-0}=\frac{3}{4}$

h $\frac{22-10}{9-6}=\frac{12}{3}=4$

i $\frac{7-3}{19-1}=\frac{4}{18}=\frac{2}{9}$

Question 2

a $\frac{29-(-1)}{10-0}=\frac{30}{10}=3$

b $\frac{56-1}{12-1}=\frac{55}{11}=5$

c $\frac{8-3}{20-0}=\frac{5}{20}=\frac{1}{4}$

d $\frac{-7-7}{8-1}=\frac{-14}{7}=-2$

e $\frac{20-(-4)}{40-0}=\frac{24}{40}=\frac{3}{5}$

f $\frac{-3-4}{16-2}=\frac{-7}{14}=-\frac{1}{2}$

Exercise 7.03 Linear modelling

Question 1

a

h	1	2	3	4	5	6
N	6	11	16	21	26	31

b N

c $m = \dfrac{31-6}{6-1} = \dfrac{25}{5} = 5$

Sub in (1,6) $N = mh + c$

$6 = 5 \times 1 + c$

$c = 1$

$\therefore N = 5h + 1$

d $N = 5h + 1$

$= 5 \times 20 + 1$

$= 101$

e $N = 5h + 1$

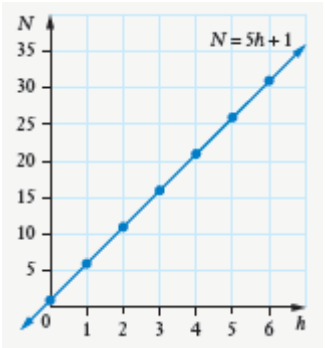
$81 = 5h + 1$

$80 = 5h$

$h = \dfrac{80}{5}$

$= 16$

f



g gradient 5, vertical intercept 1

Question 2

a $m = \dfrac{1222-102}{15-1} = \dfrac{1120}{14} = 80$

$\therefore C = mt + c$

$102 = 80 \times 1 + c$

$102 = 80 + c$

$c = 22$

$\therefore C = 80t + 22$

b C

c $C = 80t + 22$

$= 80 \times 18 + 22$

$= 1462$ c

$= \$14.62$

d 22, starting cost of call (at 0 min) in cents

e Cost of 5 min call: $C = 422$ c

Cost of 2 min call: $C = 182$ c

Cost of extra 3 mins $= 422 - 182$

$= 240$

$\therefore \$2.40$ extra

f $\$5.82 = 582$ c

$\therefore 582 = 80t + 22$

$560 = 80t$

$t = \dfrac{560}{80}$

$= 7$ minutes

Question 3

a dependent

b $m = \dfrac{198-36}{44-8} = \dfrac{162}{36} = 4.5$

$\therefore S = mn + c$

$198 = 4.5 \times 44 + c$

$198 = 198 + c$

$c = 0$

$\therefore S = 4.5n$

c 4.5 runs/over

d 0, the number of runs scored after 0 overs

e **i** $S = 4.5 \times 21$

$= 94.5$

≈ 95

ii $S = 4.5 \times 50$

$= 225$

f **i** $54 = 4.5n$

$n = \dfrac{54}{4.5}$

$= 12$

ii $180 = 4.5n$

$n = \dfrac{180}{4.5}$

$= 40$

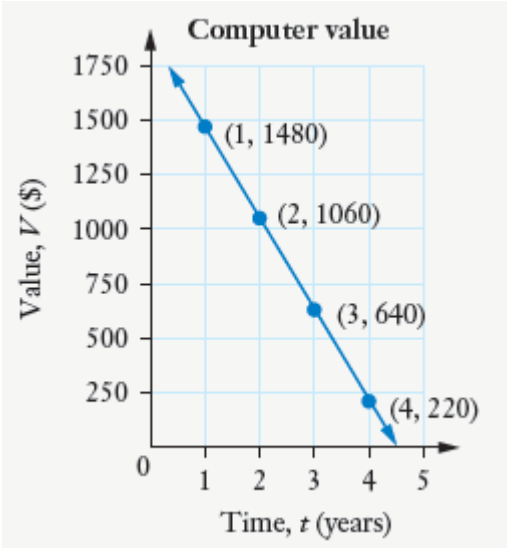
g Weaker batters bat later, with lower run rate.

Question 4

a

t	1	2	3	4
V	1480	1060	640	220

b



c Rate of depreciation in dollars per year

d $V = -420 \times 2.5 + 1900$
$= 850$

e \$1900

f V becomes negative i.e. it is less than zero.

g $0 = -420 \times t + 1900$

$420t = 1900$

$t = \frac{1900}{420}$

$= 4.523...$

≈ 4.5 years

Question 5

a $P = 50 + 3n$

b n

c \$50, the base pay

d $P = 3 \times 28 + 50$
$= \$134$

e $98 = 3n + 50$

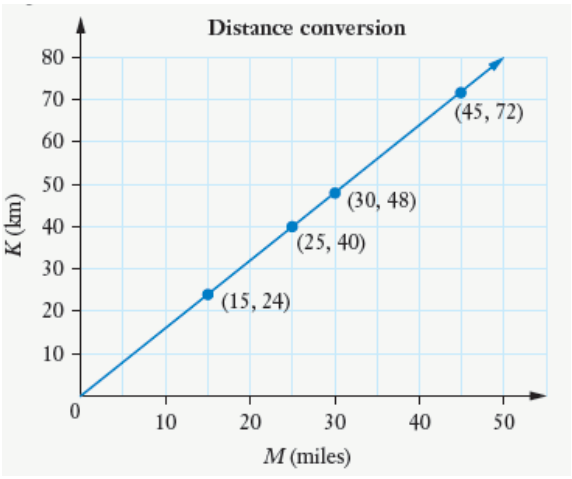
$48 = 3n$

$n = \frac{48}{3}$

$= 16$

Question 6

a



b $m = \dfrac{72-24}{45-15} = \dfrac{48}{30} = 1.6$

$\therefore K = 1.6M + c$

$72 = 1.6 \times 45 + c$

$72 = 72 + c$

$c = 0$

$\therefore K = 1.6M$

c 0, 0 miles = 0 km

d 1.6, the number of kilometres in 1 mile

e **i** $K = 1.6M$

$= 1.6 \times 100$

$= 160$ km

ii $100 = 1.6M$

$M = \dfrac{100}{1.6}$

$= 62.5$ miles

f **i** about 19 km

ii about 13 miles

Question 7

a C

b $m = \dfrac{25.2 - 8.4}{30 - 6} = \dfrac{16.8}{24} = 0.7$

$\therefore C = md + c$

$25.2 = 0.7 \times 30 + c$

$25.2 = 21 + c$

$c = 4.2$

c $C = 0.7d + 4.2$

d extra cost $= 0.7 \times 5$

$= \$3.50$

e **i** $C = 0.7 \times 20 + 4.2$

$= \$18.20$

ii $C = 0.7 \times 0 + 4.2$

$= \$4.20$

f $C = 0.7d + 4.2$

$37.80 = 0.7d + 4.2$

$33.60 = 0.7d$

$d = \dfrac{33.60}{0.7}$

$= 48$ km

Question 8

a independent

b $m = \dfrac{200 - 72}{28 - 12} = \dfrac{128}{16} = 8$

$\therefore n = mT + c$

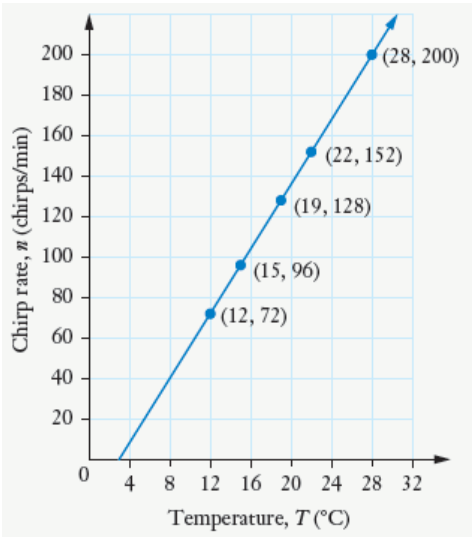
$200 = 8 \times 28 + c$

$200 = 224 + c$

$c = -24$

$\therefore n = 8T - 24$

c



d chirp rate $= 8 \times 2 = 16$

$\therefore$ increase by 16 chirps/min

e $n = 8 \times 26 - 24$

$= 184$ chirps/min

f $144 = 8T - 24$

$168 = 8T$

$T = \dfrac{168}{8}$

$= 21°\text{C}$

g –24, ‘chirp rate cannot be negative. The number of chirps per minute cannot be below zero.

Exercise 7.04 Direct linear variation

Question 1

x	1	4	6	10	11	15
y	3.5	14	21	35	38.5	52.5

Question 2

a $k = \dfrac{55}{20}$

$= 2.75$

$\therefore d = 2.75r$

b $d = 2.75 \times 33$

$= 90.75$ m

c $99 = 2.75 \times r$

$r = \dfrac{99}{2.75}$

$r = 36$ revolutions

Question 3

a $k = \dfrac{147}{25}$

$= 5.88$

$\therefore p = 5.88d$

b $p = 5.88 \times 40$

$= 235.2$ kPa

c $833 = 5.88d$

$d = \dfrac{833}{5.88}$

$= 141\frac{2}{3}$ m

Question 4

a $F = kd$

$600 = k \times 250$

$k = \dfrac{600}{250}$

$= 2.4$

$\therefore F = 2.4d$

b $F = 2.4 \times 3250$

$= 7800$ kg

Question 5

a $y = kx$

$$118.4 = k \times 74$$
$$k = \frac{118.4}{74}$$
$$= 1.6$$
$$\therefore y = 1.6x$$

b $y = 1.6 \times 60$
$= 96$ km/h

c $120 = 1.6x$
$$x = \frac{120}{1.6}$$
$= 75$ miles/h

Question 6

Drops 1.6° per min.

$$\therefore \frac{10}{1.6} = 6.25 \text{ min}$$
$\therefore$ A

Question 7

a $V = kt$
$320 = k \times 5$
$$k = \frac{320}{5}$$
$= 64$

b Increase in water volume per minute

c $V = 64t$
$= 64 \times 8$
$= 512$ L

d $V = 64t$
$960 = 64t$
$$t = \frac{960}{64}$$
$= 15$ min

Question 8

a $\frac{45}{9.75} \times 26 = 120$ mins or 2 hours

b The marathon runner cannot continue to run forever and keep travelling more distance; he needs to rest.

Question 9

$M = kE$

$27.4 = k \times 72$

$k = \frac{27.4}{72}$

$= 0.380...$

$\therefore M = 0.380...E$

a $M = 0.380... \times 60$

$= 22.83...$

≈ 22.8 kg

b $32 = 0.380...E$

$E = \frac{32}{0.380...}$

$= 84.08...$

≈ 84.1 kg

Question 10

11.25 L/h

$\frac{100}{11.25} = 8.88...$ hours

≈ 8 hours 53 min

Question 11

$\frac{1800}{36} = 50$ kilobytes/second

a $\frac{3000}{50} = 60$ seconds

b $50 \times 80 = 4000$ kilobytes

Question 12

$125N$ per 1 cm

$\therefore \frac{5000}{125} = 40 \text{ cm}$

$\therefore \text{B}$

Question 13

a $m = \frac{(325-0)}{(250-0)} = \frac{325}{250}$

$= 1.3$

$\therefore S = 1.3h$

b $S = 1.3 \times 244$

$= 317.2 \text{ cm}$

c $120 = 1.3h$

$h = \frac{120}{1.3}$

$= 92.30...$

$\approx 92 \text{ cm}$

Question 14

$\frac{49}{5} = 9.8 \text{ m/s}$

a $9.8 \times 12 = 117.6 \text{ m/s}$

b $\frac{175}{9.8} = 17.857...$

$\approx 18 \text{ s}$

c This model loses accuracy as time becomes greater. An object dropped under gravity will accelerate until it reaches terminal velocity or hits the ground.

Exercise 7.05 Conversion graphs

Question 1

a 107 cm

b 5.9 ft

c **i** 61 cm

ii 76 cm

iii 182 cm

d Answers will vary.

Question 2

a A$127

b A$52

c A$110

d A$75

e A$36

f A$60

Question 3

a Look up €12, get ≈ A$17.3 → €120 ≈ A$1.73

b Look up €80, get ≈ A$115 → €0.80 ≈ A$1.15

c Look up €34, get ≈ A$49 → €3.40 ≈ A$4.90

d Look up €12.5, get ≈ A$18 → €1.25 ≈ A$1.80

Question 4

a €17

b €53

c €22

d €90

e €75

f Look up A$75, get ≈ €52 → A$7.50 ≈ €5.20

Question 5

$(0,0)$ $(100,144)$

$m = \dfrac{144}{100} = 1.44$

This represents the number of A$ per €, i.e., €1 equals A$1.44.

Question 6

a **i** 72 kg

ii 56 kg

iii 80 kg

b **i** 185 cm

ii 159 cm

iii 193 cm

c $(165,62)$ $(185,75)$

$m = \dfrac{75-62}{185-165} = \dfrac{13}{20} = 0.65$

This gradient represents the rate of change of weight per height in kg/cm.

Question 7

a **i** $51

ii $24

iii $70

b **i** $29

ii $94

iii $63

c $(40,34)$ $(106,90)$

$m = \dfrac{90-34}{106-40} = \dfrac{56}{66} = 0.85$

The gradient value represents the discount price as a proportion of the marked price.

d C

Question 8

a **i** 41 kg

ii 62 kg

iii 73 kg

b **i** 88 lb

ii 140 lb

iii 198 lb

c $(0,0)$ $(175,80)$

$$m = \frac{80-0}{175-0}$$
$$= \frac{80}{175}$$
$$= 0.457...$$
$$\approx 0.46 \text{ kg/lb}$$

$\therefore$ The conversion rate is 0.46 kg/lb.

Sample HSC problem

a $m = \dfrac{48-4}{18-7}$

$= \dfrac{44}{11}$

$= 4$

$\therefore P = 4n + c$

$48 = 4 \times 18 + c$

$48 = 72 + c$

$c = -24$

$\therefore P = 4n - 24$

b 4, increase in pocket money in dollars per year of age.

c $P = 4 \times 16 - 24$

$= 40$

Amount of pocket money = \$40.

d $P = 4 \times n - 24$

$20 = 4n - 24$

$44 = 4n$

$n = \dfrac{44}{4}$

$= 11$

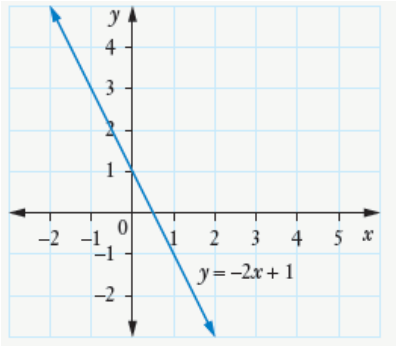
e **i** Values of P will be 0 or less

ii After 18 years, children become adults and either receive no pocket money or an amount based on a different formula.

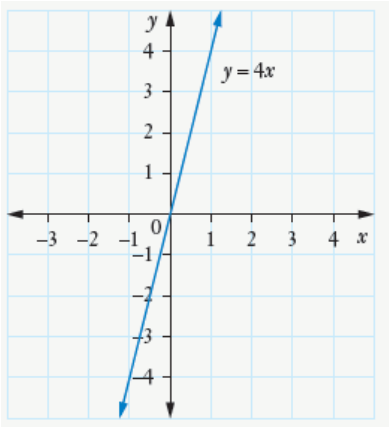
Test yourself 7

Question 1

a



b



Question 2

a $m = \dfrac{0-1}{2-1} = \dfrac{-1}{2} = -\dfrac{1}{2}$

$c = 1$

$\therefore y = -\dfrac{1}{2}x + 1$

b $m = \dfrac{0-(-3)}{1-0} = \dfrac{3}{1} = 3$

$c = -3$

$\therefore y = 3x - 3$

Question 3

a $m = \dfrac{18-3}{10-4} = \dfrac{15}{6} = 2\dfrac{1}{2}$

b $m = \dfrac{17-5}{1-5} = \dfrac{12}{-4} = -3$

Question 4

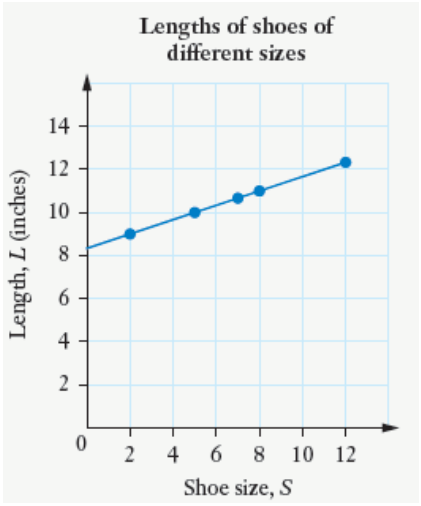
a $m = \dfrac{18-12}{12-0} = \dfrac{6}{12} = \dfrac{1}{2}$

b $m = \dfrac{6-42}{11-2} = \dfrac{-36}{9} = -4$

Question 5

a S

b



c $(2,9)\quad(8,11)$

$$m=\frac{11-9}{8-2}$$
$$=\frac{2}{6}$$
$$=\frac{1}{3}$$

The gradient represents the increase in length per shoe size, in inches/size.

d $8\frac{1}{3}$ inches, the vertical intercept

e $L=\frac{1}{3}S+8\frac{1}{3}$

f $L=\frac{1}{3}\times 7\frac{1}{2}+8\frac{1}{3}$

$$=10\frac{5}{6}$$

g $L=\frac{1}{3}S+8\frac{1}{3}$

$$13=\frac{1}{3}S+8\frac{1}{3}$$
$$\frac{14}{3}=\frac{1}{3}S$$
$$S=14$$

Question 6

$d = kr$

$950 = k \times 540$

$k = \dfrac{950}{540}$

$= 1.759...$

$\therefore d = 1.759... \times r$

$= 1.759... \times 10\,000$

$= 17592.59...$ m

$= 17.592...$ km

≈ 18 km

Question 7

a **i** \$31

ii \$93

b **i** 1700 baht

ii 2150 baht

c $(0,0)$ $(2350,90)$

$m = \dfrac{90-0}{2350-0}$

$= \dfrac{90}{2350}$

$= 0.038...$

≈ 0.04

This represents the number of A\$ per baht, i.e., 1 baht = A\$0.04

