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5.5 Modelling with straight lines.

1) a) i $k = \frac{y_2 - y_1}{x_2 - x_1}$ Let $x_1 ; y_1 = (0,0)$ $x_2 ; y_2 = (20, 250)$ } or any other 2 coordinates

$k = \frac{250 - 0}{20 - 0}$

$k = \frac{25}{2}$

ii The units for the gradient are $\frac{\text{units of y-axis}}{\text{units of x-axis}} =$

$= \frac{\text{cost}}{\text{number of concert tickets}}$ = cost per concert ticket

iii direct proportion equation is $y = kx$ where k is constant $\therefore C = \frac{25}{2} n$

b) i $x_1 ; y_1 - (0,0)$

$x_2 ; y_2 - (6, 10)$

$k = \frac{10 - 0}{6 - 0}$

$k = \frac{5}{3}$

ii $\frac{\text{Distance}}{\text{Time}} = ms^{-1}$

iii $d = \frac{5}{3} t$

c) i $x_1 ; y_1 - (0,0)$

$x_2 ; y_2 - (20, 900)$

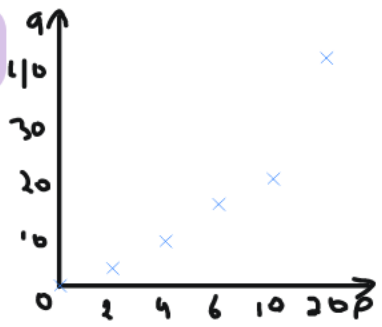
$k = \frac{900 - 0}{20 - 0}$

$k = 45$

ii $\frac{\text{Miles}}{\text{Gallons of Petrol}}$: miles per gallon

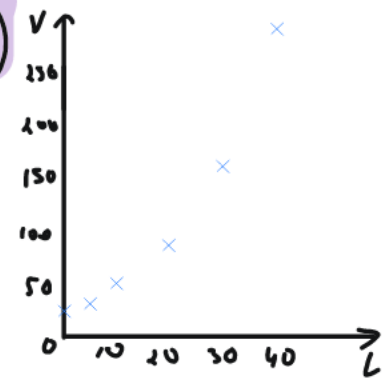
iii $m = 45g$

2) a)



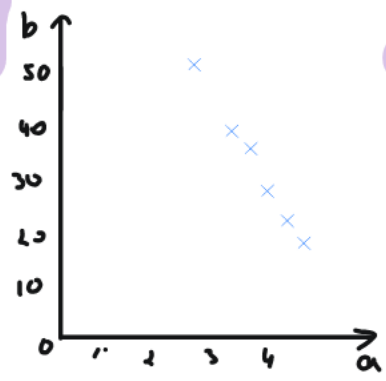
linear model is appropriate for this set of data ∴ the points lie approximately on the same line.

b)



linear model is not appropriate for this set of data ∴ the points do not lie approximately on the same line.

c)



linear model is appropriate for this set of data ∴ the points lie approximately on the same line.

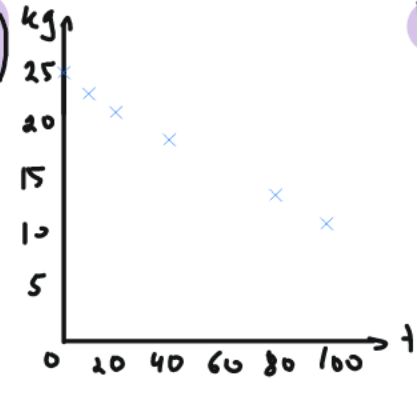
3) a) $k = \frac{y_2 - y_1}{x_2 - x_1}$ $k = \frac{25 - 0}{20 - 0} = 1,25$

b) $d = mp + c$ $m = 1,25$ $c = 0$

$d = 1.25(p)$ $0 = 1.25(0) + c$

c) The number of US dollars per British pound

4) a)



linear model is appropriate ∴ the points lie approximately on the same line.

4) b) $w = at + b$ $\quad a = \frac{23.4 - 24.8}{10 - 0}$ $\quad b = 24.8$

$w = -0.14t + 24.8$ $\quad a = -0.14$

$w = at + b$

$b = 24.8 = -0.14(0) + b$

$b = 24.8$

c) a is the number of kg the weight goes down by per second.
b is the initial weight of the bag of send.

d) Empty bag means $w = 0$ $\quad w = at + b$

$0 = -0.14(t) + 24.8$

$0.14t = 24.8$

$t = \frac{24.8}{0.14} = 177\ s$

e) The estimate assumes that rate of flow is constant but the reduced weight of sand in the bag may cause the sand to flow at slower rate.

5) a) $v = a + bt$ $\quad b = \frac{20 - 8}{4 - 0}$

$v = 8 + 3(t)$ $\quad b = 3$

$v = a + bt$

$20 = a + 3(4)$

$20 = a + 12$

$8 = a$

b) a is the velocity

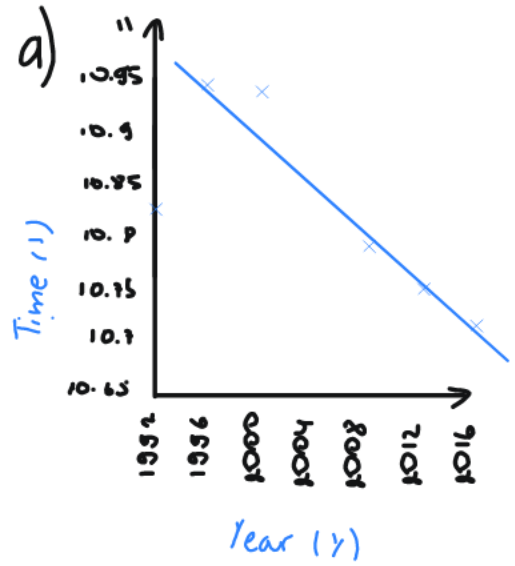
b is acceleration

c) $v = 8 + 3(15)$

$v = 53\ ms^{-1}$

d) The model suggest the speed will continue to increase indefinitely at a constant rate which is not possible.

6) a)



b) $T = aY + b$

$T = -0.0115Y + 33.894$

$a = \frac{10.71 - 10.94}{2016 - 1996}$

$a = -0.0115$

$10.94 = -0.0115(1996) + b$

$10.94 = -22.954 + b$

$33.894 = b$

c) $T = -0.0115(2020) + 33.894$

$T = 10.664$

d) Model is invalid as it would eventually predict time ≤ 0

7) a) $C = am + b$

$C = 3.6m + 2.4$

$a = \frac{56.40 - 20.40}{15 - 5}$

$a = 3.6$

$20.40 = 3.6(5) + b$

$20.40 = 18 + b$

$b = 2.4$

b) a is a cost per mile

b is standing charge

c) $C = 3.6(12) + 2.4$

$C = 45.6$ £

8) a) $V = at + b$

$V = -1095(t) + 5475$

$a = \frac{4380 - 5475}{1 - 0}$

$a = -1095$

$5475 = -1095(0) + b$

$5475 = b$

b) The rate of change of the value of motorbice

c) $V = -1095(t) + 5425$

$V = -1095(2.5) + 5472$

$V = 2734.50£$

d) The model suggests that the value will be negative after few years which is not realistic.