Answers & Solutions

Examination Paper 1

1. – 0.11
2. (a) $5.4 \times 10^{84} + 39.7 \times 10^{82}$
   $= 5.4 \times 10^{84} + 0.397 \times 10^{84}$
   $= 5.797 \times 10^{84}$
   (b) 0.2 million , 34000, 1.98×10^4, 415×10^0, 23.7×10^{-3}
3. (a) $5^2 + 4$
   (b) $n^2 + (n - 1)$
   (c) 10,099
4. (a) $B = \frac{100}{121}$
   (b) 700%
5. (a) $6 - r$
   (b) $60^\circ = \frac{\pi}{3}$
   $CD = r\theta = r\left(\frac{\pi}{3}\right)$
   (c) Perimeter of shaded region
   $= r\left(\frac{\pi}{3}\right) + 2(6 - r) + 6$
   $= r\left(\frac{\pi}{3}\right) + 18 - 2r$
   Major arc $= \left(2\pi - \frac{\pi}{3}\right)r$
   $= \frac{5\pi}{3}r$
   Hence
   $r\left(\frac{\pi}{3}\right) + 18 - 2r = \frac{5\pi}{3}r$
   $\rightarrow r = 2.90848 = 2.91$ (3 s.f.)
   (d) Shaded region
   $= \frac{1}{2}(6)(6)\sin 60 - \frac{1}{2}(2.90848)^2\left(\frac{\pi}{3}\right)$
   $= 15.588 - 4.42983$
   $= 11.158$
   $= 11.2\ \text{cm}^3$
6. (a) $36a^2 - 1 = (6a + 1)(6a - 1)$
   (b) $a^2 + 5a - 6$
   $= (a + 6)(a - 1)$
   (c) $9 - 3a + 3b - ab$
   $= 3(3 - a) + b(3 - a)$
   $= (3 + b)(3 - a)$
7. (a) Distance $= S \times T$
   $= 60 \times 2$
   $= 120$ km
   (b) Both the speed and time were rounded down, therefore the actual distance is greater than the answer in part (a).
8. (a) \$90 000 – \$50 000 = \$40 000
   (b) $I = \frac{\$40\,000 \times 2 \times 4}{100} = \$3200$
   \$40 000 + \$3200 = \$43 200
   \$43 200 ÷ 24 = \$1800
9. (a) $2A + B = 2\begin{pmatrix} 3 & -2 \\ 1 & 5 \end{pmatrix} + \begin{pmatrix} 11 & -16 \\ 12 & 19 \end{pmatrix} = \begin{pmatrix} 17 & -20 \\ 14 & 29 \end{pmatrix}$
   (b) $A^2 = \begin{pmatrix} 3 & -2 \\ 1 & 5 \end{pmatrix}\begin{pmatrix} 3 & -2 \\ 1 & 5 \end{pmatrix} = \begin{pmatrix} 7 & -16 \\ 8 & 23 \end{pmatrix}$
   (c) $C = B - 3A$
   $= \begin{pmatrix} 11 & -16 \\ 12 & 19 \end{pmatrix} - 3\begin{pmatrix} 3 & -2 \\ 1 & 5 \end{pmatrix} = \begin{pmatrix} 2 & -10 \\ 9 & 4 \end{pmatrix}$
10. (a) Mean $= 2\frac{1}{6}$
    $\frac{0(8) + 1(9) + 2(5) + 3(4) + 4(x) + 5(7)}{8 + 9 + 5 + 4 + x + 7} = 2\frac{1}{6}$
    $\frac{66 + 4x}{33 + x} = \frac{13}{6}$
    $6(66 + 4x) = 13(33 + x)$
    $24x + 396 = 429 + 13x$
    $11x = 33$
    $x = 3$
    (b) Smallest possible value of $x = 10$
    (c) Largest possible value of $x = 18$
11. (a) 64.3 m
    (b) 76.9°
    (c) 2.4 m
12. (a) $\angle BAE = 180° - 2(48°) = 84°$
    (Base ∠s of isos. triangles are equal)
    (b) $\angle AED = 90°$
    (∠ in a semi-circle)
    (c) $\angle BED = 90° - 48° = 42°$
    (d) $\angle BCD = 180° - 42° = 138°$
    (∠s in the opp. segment)
    (e) $\angle ABE = 48°$
    (Base ∠s of isos. triangle are equal)
    $\angle ADE = 48°$
    (∠s in the same segment)

13. (a) $8x \le 6(x+2)$, $6(x+2) \le 3(3x+7)$
$2x \le 12$, $6x + 12 \le 9x + 21$
$x \le 6$, $12 - 21 \le 3x$
$-3 \le x$
$\therefore -3 \le x \le 6$

14. (a) $9a^3$
(b) $\frac{4y^2}{x}$

15. (a) -3
(b) $k = -2$ or 1

16. (a) 2.05
(b) $2.05 \times 10^9 - 8.46 \times 10^8$
$= 1.204 \times 10^9$

17. (a) $y \propto x^2$
$y = kx^2$
$48 = 16k$
$k = 3$
$y = 3x^2$
(b) $y = 3(4.5)^2$
$= 60.75$
(c) $147 = 3x$
$x = 49$
$x = \pm 7$

18. (a) $\sqrt[3]{8x} = 2x^{\frac{1}{3}}$
(b) $\frac{22}{7}\left(x^{\frac{3}{4}}\right)^2 (7x^{\frac{5}{6}})$
$= 22x^{\frac{7}{3}}$

19. (a) 1 cm : 50 000 cm
1 cm : 500 m
0.4 cm : 200 m
(b) 1 cm : 0.5 km
1 cm^2 : 0.25 km^2
3.8 cm^2 : 0.95 km^2

20. (a) $x \ge 150$, $x \le 400$
(b) \$2400
(c) \$900

21. $y = 2$ or $\frac{2}{3}$

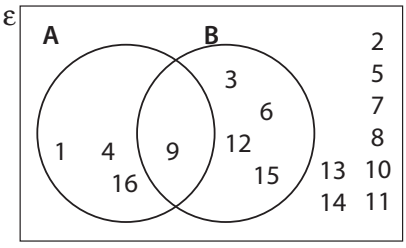
Examination Paper 2

1. (a) $I = \frac{PRT}{100}$
$3300 = \frac{P(5.5)(3)}{100}$
$P = 20\,000$
(b) Bank A:
$A = P\left(1 + \frac{r}{100}\right)^n$
$A = 20\,000\left(1 + \frac{5 \div 12}{100}\right)^{36}$
$A = 23\,229.44$
Bank B:
Total \$23 300
Mrs Lee received a better interest with Bank B.

2. (a) No. of fiction books = 1260
No. of non-fiction books = 3240
Total no. of books = 4500
(b) (i) Total cost of books = \$3199.50
(ii) Percentage increase = 6.8%

3. (a) (i) $x^3y - xy = xy(x^2 - 1)$
$= xy(x - 1)(x + 1)$
(ii) $9x^2 - 3xy - 12y^2 = 3(x + y)(3x - 4y)$
(b) $\frac{3}{x^2 + x - 2} - \frac{1}{x - 1} = \frac{3}{(x-1)(x+2)} - \frac{1}{x-1}$
$= \frac{3}{(x-1)(x+2)} - \frac{1(x+2)}{(x-1)(x+2)}$
$= \frac{3 - x - 2}{(x-1)(x+2)}$
$= \frac{1 - x}{(x-1)(x+2)} = \frac{-(x-1)}{(x-1)(x+2)}$
$= \frac{-1}{x+2}$
(c) $a = \sqrt[3]{\frac{ab}{t} + a^2}$
$a^3 = \frac{ab}{t} + a^2$
$\frac{ab}{t} = a^3 - a^2$
$t = \frac{ab}{a^2(a-1)}$
$t = \frac{b}{a(a-1)}$

(d) (i) A = (1, 4, 9, 16)

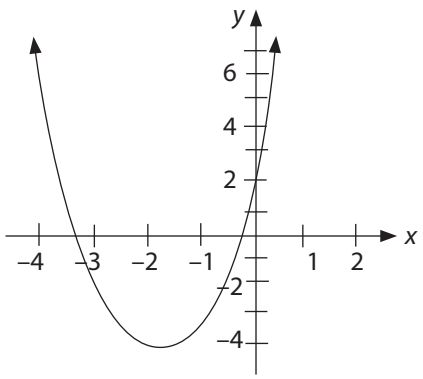
(ii) 

(iii) $A' \cap B = (3, 6, 12, 15)$

(iv) $n(A \cup B) = 8$

4. (a) $x = -2$ or 2

(b) $2\left(x + \frac{7}{4}\right)^2 - 4\frac{1}{8}$



$\left(-1\frac{3}{4}, -4\frac{1}{8}\right)$

5. (a) $\frac{1}{x}$

(b) $\frac{1}{x + 0.2}$

(c) $\frac{1}{x} - \frac{1}{x + 0.2} = \frac{3}{5}$

(d) 0.49, –0.69

(e) 40 min 50s

6. (a) There were 16 teenagers in the competition.

(b) Maximum distance thrown = 42 m

(c) Percentage of teenagers who qualified $= \frac{5}{16} \times 100 = 31.3\%$

7. (a) (i) 170 m

(ii) 19.7°

(iii) 059.7°

(iv) 3220 m^2

(b) 11.6°

8. (a) $\angle DCA = 35°$ (alt. segment theorem)

(b) $\angle OAT = 90°$ (tan $\perp$ rad)

$\angle OAD = 90° - 35°$

$\angle OAD = 55°$

(c) $\angle CAO = \angle DCA$ (alt. $\angle$s, OA // CD)

$= 35°$

$\angle COA = 180° - 35° - 35°$ (isos. Δs, OC = OA)

$= 110°$

$\angle CBA = \frac{110°}{2}$ ($\angle$ at centre = 2 $\angle$ at circumference)

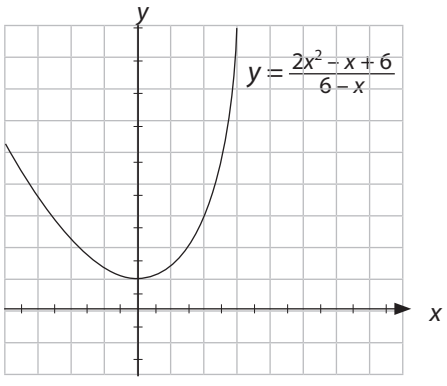
$= 55°$

(d) $\angle CDA = 180° - 55°$ ($\angle$s in opp. segment)

$OAD = 125°$

9. (a) $y = 2, 1.4, 3, 7$

(b)



(c) Ruled straight line $y = 4 + \frac{1}{3}x$

$x = 2.58$ to 2.65 and x

$= -3$ to -2.85

(d) $-2.9 < x < 2$

(e) Tangent drawn at x

$= 1.8$ and attempt at $\frac{\Delta y}{\Delta x}$

Gradient = 1.9 to 2.14

Examination Paper 3

1. (a) 0.023 (b) 2.3×10^{-2}

2. (a) 2 h 45 min $= 2\frac{45}{60} = 2\frac{3}{4}\,h$

(b) 192.5 km

3. (a) 27 minutes

(b) $\frac{10}{24} \times 100 = 41\frac{2}{3}\%$

(c) The new range of the times will be from 3 min to 54 min instead of the original 5 min to 56 min.

4. LCM of 2, 5 & 11 = 110 min

0800 + 110 min = 0950

5. $\frac{130}{100} \times 120 = 156$

$\frac{780}{156} \times 100\% = \$500$

6. (a) It is for $y = ka^x$ because when $x = 0$, $y = k \neq 0$.

(b) $a = 5, k = 2$

7. (a) $\frac{216}{360} \times 2 \times 3.142 \times 15 = 56.556$ cm

Perimeter $= 15 + 15 + 56.556$

$= 86.556$ cm

(b) (i) $86.556 = 2\pi r$

$r = 13.774 = 13.8$ cm

(ii) $h = \sqrt{15^2 - 13.8^2}$

$= 5.88$ cm

(iii) Volume of cone $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times 3.142 \times 13.8^2 \times 5.88$

$= 1172.8\ \text{cm}^3$

(c) (i) $\pi rl = 3.142 \times 13.8 \times 15$

$rl = 650.4\ \text{cm}^2$

(iii) Vol. of 1 sphere $= \frac{4}{3}(3.142)(1)^3$

Vol. $= 4.19\ \text{cm}^3$

Max. no. of ball bearings

$= \frac{1172.8}{4.19} = 279.9$

≈ 279

8. (a) $A = (-2, 0)$
$B = (1, 0)$
$C = (0, 2)$
(b) $AB = 3$ units

9. (a) (i) $3mn(m + 3n - 5mn)$
(ii) $16a^2 - 36b^2 = 4(4a^2 - 9b^2)$
$= 4(2a+3b)(2a-3b)$
(b) $\frac{3p - y}{2y + p} = x^2$
$3p - y = x^2(2y + p)$
$3p - y = 2x^2y + x^2p$
$3p - x^2p = 2x^2y + y$
$p(3 - x^2) = 2x^2y + y$
$p = \frac{2x^2y + y}{3 - x^2}$

10. (a) $-1 < \frac{2x - 3}{2}$
$x > \frac{1}{2}$ and $\frac{2x - 3}{2} < 5$
$x < 6\frac{1}{2}$
$\frac{1}{2} < x < 6\frac{1}{2}$
(b) (i) -5 (ii) 25
(iii) -5

11. (a) $\cos 40° = \frac{8}{PQ}$
$PQ = \frac{8}{\cos 40°}$
≈ 10.44
≈ 10.4 cm (3 s.f)
(b) $PS^2 = PQ^2 - QS^2$
$\approx (10.44)^2 - 8^2$
≈ 44.99
≈ 45
$PR^2 = PS^2 + SR^2$
$= 45 + 10^2$
$\therefore PR \approx 12.04$
≈ 12.0 cm (3 s.f.)
(c) $\tan \angle PRS = \frac{PS}{10} = \frac{\sqrt{45}}{10} \approx 0.6708$
$\therefore \angle PRS \approx 33.9°$ (1 d.p.)

12. (a) Area of the field surface $= x^2 + (2\sqrt{x})^2$
$= x^2 + 4x$
(b) $x^2 + 4x = 320$
$x^2 + 4x - 320 = 0$
(c) $x^2 + 4x - 320 = 0$
c.f. $ax^2 + bx + c = 0$
$a = 1, b = 4, c = -320$
$x = \frac{-4 \pm \sqrt{b^2 - 4ac}}{2a}$
$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(-320)}}{2(1)}$
$x = 16, x = -20$
(Inadmissible, length of side cannot be negative.)
Perimeter of the field surface
$= 4x + 4\sqrt{x}$
$= 4 \times 16 + 4\sqrt{16} = 80$ m

13. (a) $\angle AGE = \angle CDE$ (alt. $\angle$s, $AG//DC$)
$\angle GAE = \angle DCE$ (alt. $\angle$s, $AG//DC$)
$\angle AEG = \angle CED$ (vert. opp. angles)
By AAA, ΔAGE is similar to ΔCDE
(b) Area of $\Delta AGE = \frac{1}{2} \times 20 \times 8.5 = 85$ cm^2
(c) Since ΔAGE is similar to ΔCDE,
$ME : NE = 20 : 14 = 10 : 7$
Hence, 17 units represents 8.5 cm
$ME = 10$ units $= 5$ cm

14. (a) \$48 000
(b) 14
(c) (i) 36 (ii) \$183.70

15. (a) (i) ΔABC is similar to ΔAXY
(ii) $BC = 9$ cm
(b) (i) ΔCZB is similar to ΔXZY
(ii) $\frac{2}{3}$
(c) (i) $\frac{4}{9}$ (ii) $\frac{1}{3}$

Examination Paper 4

1. (a) Selling price = 300% × \$0.50 = \$1.50

   (b) $1.5 \times 40 + 1 \times 40$

   Mr Koh paid \$100

   (c) $1.5 \times 300 + 0.8 \times 300$

   Mr Poh paid \$690

   (d) Remaining key chains sold for

   $660 \times 0.8 = \$528$

   Profit = [their (i) + their (ii) + \$528] − 500

   = \$818

2. (a) (i) $P = 2N - 1$

   (ii) $Q = 3 \times 2^{N-1}$

   (iii) $R = 5N$

   (b) When $N = 10$,

   $3 \times 2^{10-1} = 1536$

   $2(10) - 1 = 19$

   Tom shape = $1536 \times 19 = 29184$

   Sandy shape = $5 \times 10 \times 5 \times 10 = 2500$

   ∴ Tom's shape will be bigger.

3. (a) Amount of money to be paid

   $= 3x + 10\ (10) = 3x + 100$

   (b) $700 \leq 3x + 100 \leq 1000$

   $600 \leq 3x \leq 900$

   $200 \leq x \leq 300$

   Maximum no. of students = 300

   Minimum no. of students = 200

   (c) (i) 0.0001

   (ii) $1 \times 10^{-4} \times 4.2 \times 10^{7} = 4.2 \times 10^{3}$ teenagers and children.

   Number of teenagers

   $= 4.2 \times 10^{3} \times \frac{9}{9+1} = 3780$

4. (a) (i) $AB = CD = 5$ cm (given)

   $\angle AEB = \angle DEC$ (vert. opp. ∠ s)

   $\angle ABE = \angle DCE = 90°$ (∠ in a semi-circle)

   ∴ Triangles *AEB* and *DEC* are congruent (AAS)

   (ii) $AC = \sqrt{13^2 - 5^2}$

   $AC = 12$ cm

   Area of triangle *ACD*

   $= \frac{1}{2} \times 12 \times 5 = 30\ \text{cm}^2$

   (b) (i) $\frac{ST}{PR} = \frac{4}{6} = \frac{2}{3}$

   (ii) $\frac{\text{Area of triangle } SQT}{\text{Area of triangle } PQR} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$

   (iii) $\frac{\text{Area of trapezium } PSTR}{\text{Area of triangle } PQR} = \frac{5}{9}$

5. (a) $\frac{1}{4}\pi(6)^2 h = 480$

   $h = \frac{480}{12\pi}$

   $h = 12.7$cm

   (b) $\frac{1}{2} \times \frac{4}{3} \times \pi \times (6)^3 = 452\ \text{cm}^3$

   $\approx 480 + 452 = 932\ \text{cm}^3$

   (c) $452 \times 0.7 + 480 \times 4.3$

   ≈ 2380 g

   (d) $\pi(8)^2\ (24) = 1536\pi$

   $1536\pi \div 480 = 10.053$

   10 cones can be made.

6. (a) (i) Gradient $= \frac{11-3}{7-9} = \frac{8}{-2} = -4$

   (ii) $y = mx + c$

   $11 = -4(7) + c$

   $c = 39$

   ∴ $y = -4x + 39$

   (b) A, B and C collinear.

   → Same gradient

   $\rightarrow -4 = \frac{103 - 11}{a - 7}$

   $a = -16$

   (c) (i) $2y + 5x = 10$

   Let $x = 0 \rightarrow y = 5$

   ∴ $P(0, 5)$

   Let $y = 0 \rightarrow x = 2$

   ∴ $Q(2, 0)$

(ii) $K(a, b)$

By similar triangles:

$$\frac{2}{5} = \frac{OQ}{OQ + a}$$

$$\frac{2}{5} = \frac{2}{2 + a}$$

$$a = 3$$

$$\frac{2}{5} = \frac{5}{b}$$

$$b = 12.5$$

$\therefore K(-3, 12.5)$

7. (a) Hexagon

(b) (i) Each exterior $\angle = \frac{360°}{6} = 60°$

Each interior $\angle = 180° - 60° = 120°$

$\angle AFE$ is an interior angle

$\therefore \angle AFE = 120°$

(ii) Since ABC is an isos. Δ,

$$\angle BCA = \frac{180° - 120°}{2} = 30°$$

($\angle$ sum of Δ)

(iii) $\angle ACD = 120° - 30° = 90°$

or $\angle ACD = 90°$

(right $\angle$ in semicircle)

(c) Since $\angle ACD = 90°$, AD must be the diameter (right $\angle$ in semicircle)

(d) (i) $\angle FOE = \frac{360°}{6} = 60°$

$$\angle OFE = \frac{180° - 60°}{2} = 60°$$

(ii) $\angle FPE = 30°$

($\angle$ at centre = 2$\angle$ at circumference. OFE is an isos. Δ)

(e) $\angle ABQ = \angle BAQ = 180° - 120° = 60°$

(adj. $\angle$s on str. line)

$\therefore \angle AQB = 180° - 60° - 60° = 60°$ ($\angle$ sum of Δ)

8. (a) (i) Median = \$84

(ii) 60th percentile = \$87

(iii) Interquartile = \$93 – \$73 = \$20

(iv) $\% = \frac{200 - 170}{200} \times 100\% = 15\%$

(b) (i) Interquartile = \$96 – \$56 = \$40

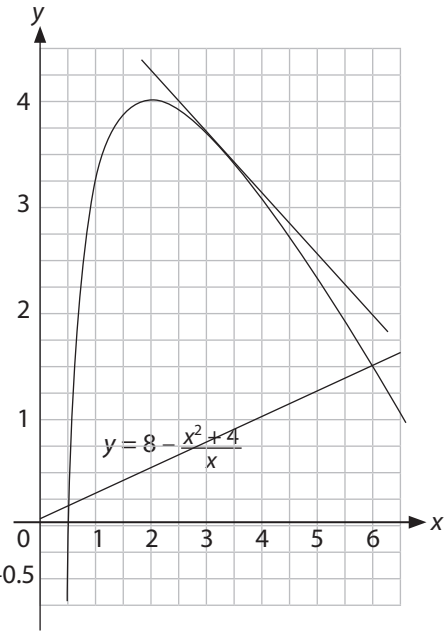
(ii) October has a wider spread of pocket money. Because the interquartile range in October is greater than that in September.

9. (a) $a = 3$, $b = 3.9$

(b) Scale

Label

Smooth curve



(c) Greatest value = 4

(d) Draw line $y = mx$

Least $m = 0.22167$

Examination Paper 5

1. There is no defined scale on the vertical axis.

   The cost of water in year 2021 may be misinterpreted as 4 times the cost of water in year 2018.

2. (a) $\$hj$

   (b) $\$12hk$

   (c) $\$(12hk - hj) = \$h(12k - j)$

3. (a) 25 days

   (b) $\frac{75}{x}$ men

4. (a) 291°

   (b) 223°

5. (a) n^{10} (b) $\frac{24}{25}$

6. Package A: $\frac{6.34}{2000} = \$0.00317$/ml

   Package B: $\frac{5.85}{2 \times 830} = \frac{5.85}{1660} = \$0.003524$/ml

   Yes. Package A is cheaper.

7. (a) $x = -\frac{1}{7}, -\frac{5}{7}$

   (b) $x = -\frac{2}{3}, 4$

8. (a) $h(h - 3) = 5h + 18$

   $h^2 - 3h = 5h + 18$

   $h^2 - 8h - 18 = 0$

   $h = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(-18320)}}{2(1)}$

   $h = \frac{8 \pm \sqrt{136}}{2}$

   $h = 9.83$ or -1.83

   (b) $(1 - 4p) = \pm\frac{3}{2}$

   $p = -\frac{1}{8}$ or $\frac{5}{8}$

   (c) $7^{\frac{1}{2} - 2x} = 7^{-1}$

   $\frac{1}{2} - 2x = -1$

   $2x = \frac{1}{2} + 1$

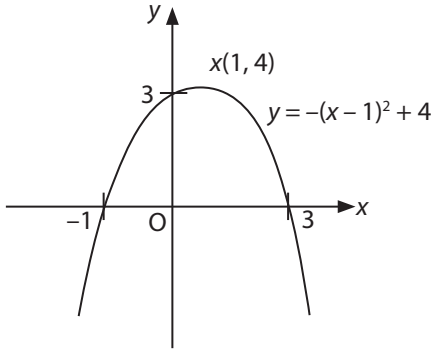
   $x = \frac{3}{4}$

9. (a) 9

   (b) 27

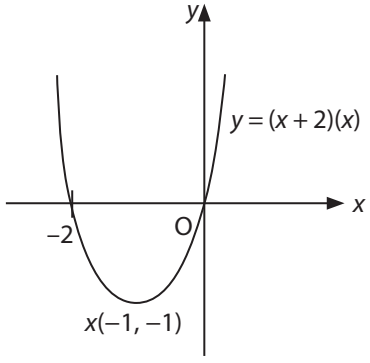
   (c) 48

10. (a) (i)



   (ii) Maximum point = (1, 4)

   (b) (i)



   (ii) Line of symmetry: $x = -1$

11. (a) 28

   (b) $T = \frac{n(n + 1)}{2}$

   (c) Pattern with 10 rows

   (d) Since n is not a whole number, the pattern does not exist.

12. (a) $500

   (b) $104

13. (a) $y = \frac{3}{5}x + \frac{48}{5}$

   Gradient $= -\frac{3}{5}$

   (b) $y = 0, 3x = 48$

   $x = 16$

   A(16,0)

   (c) $x = y, 8y = 48, y = 6$

   P = (6, 6)

14. (a) 7.14

    (b) 45.6°

    (c) 29.5

    (d) 16.4

15. (a) $7x + x^2 = 60$

    $x^2 + 7x - 60 = 0$

    $x = 5, x = -12$

    (b) $\text{Time} = \frac{0.5x}{10} + \frac{0.35x}{5} + \frac{0.15x}{3}$

    $= \frac{5.1x}{30}$

    $\text{Average speed} = x \div \frac{5.1x}{30}$

    $= \frac{30}{5.1} = 58.8 \text{ km/h}$

16. (a) $\frac{3.6 \times 10^6 - 2.1 \times 10^6}{2.1 \times 10^6} \times 100\%$

    $= 71.4\%$

    (b) $\frac{8 \times 10^4}{3.6 \times 10^6} = \frac{8}{360} = \frac{1}{45}$

    (c) $3.6 \times 10^6 - 8 \times 10^4 = 3.52 \times 10^6$

17. (a) $XY = \sqrt{(10-4)^2 + (4-3)^2}$

    $= \sqrt{37}$

    $= 6.08 \text{ units}$

    $YZ = \sqrt{(10-15)^2 + (4-10)^2}$

    $= \sqrt{61}$

    $= 7.81 \text{ units}$

    $XZ = \sqrt{(15-4)^2 + (10-3)^2}$

    $= \sqrt{170}$

    $= 13.0 \text{ units}$

    (b) Using cosine rule:

    $\cos \angle QPU = \frac{37 + 61 - 170}{2 \times \sqrt{37} \times \sqrt{61}}$

    $= -0.758$

    (c) 139°

Examination Paper 6

1. (a) $\frac{(2t+1)}{(t-s)^2}$

   (b) $y = \frac{1}{6}$

   (c) $q = \frac{4p^4}{4p^2 + p}$

   (d) $x = 1.82 \text{ or } 0.82$

2. (a) -5

   (b) $\left(\frac{2}{5}, 0\right)$

   (c) $\frac{1}{2}$

   (d) $y = -5x - 1$

   (e) $\frac{1}{10}$

3. (a) $\frac{4000}{y}$ cents

   (b) $\frac{5600}{y-20}$ cents

   (c) $\frac{5600}{y-20} - \frac{4000}{y} = 15$

   reduces to

   $3y^2 - 380y - 16000 = 0$

   (d) $y = 160$

   (e) \$24

4. (a) $\text{Ht}_B = \frac{18}{12} \times 20$

   $= 30\text{cm}$

   (b) (i) $\left(\frac{18}{12}\right)^2 = \frac{4}{9}$

   (ii) $\left(\frac{12}{18}\right)^3 = \frac{8}{27}$

   (c) $\text{Vol}_c = \left(\frac{10}{18}\right)^3 \times 9720$

   $= 1670 \text{ cm}^3$

   (d) $\frac{9720}{1667} = 6 \text{ times}$

5. (a) $H = \begin{pmatrix} 14 & 1 & 1 \\ 13 & 1 & 1 \\ 13 & 1 & 2 \\ 10 & 2 & 3 \\ 11 & 2 & 2 \end{pmatrix}$

   (b) $A = \begin{pmatrix} 8 & 2 & 5 \\ 8 & 4 & 4 \\ 8 & 3 & 4 \\ 6 & 5 & 4 \\ 4 & 4 & 8 \end{pmatrix}$

(c) $T = \begin{pmatrix} 22 & 3 & 6 \\ 21 & 5 & 5 \\ 21 & 4 & 6 \\ 16 & 7 & 7 \\ 15 & 6 & 10 \end{pmatrix}$

(d) (i) $P = \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}$

(ii) $TP = \begin{pmatrix} 69 \\ 68 \\ 67 \\ 55 \\ 51 \end{pmatrix}$

(e) (i) $Y = (310)$

(ii) Y represents the total score for all five teams for home and away matches.

(f) $Z = (62)$

Z represents the average score attained by 1 team.

6. (a) $56° + 57° = 113°$

$x = 113° - 63° = 50°$ (Ext. $\angle$ of triangle equals sum of two int. opp. $\angle$s)

(b) (i) $\frac{BC}{\sin 50°} = \frac{250}{\sin 63°}$ (sine rule)

$BC = 214.9 \approx 215$ m

(ii) $AD^2 = 270^2 + 250^2 - 2(270)(250)$ cos 57° (cosine rule)

$AD = 248.7 \approx 249$ m

(c) Area of $\Delta ABD = \frac{1}{2}(270)(250) \sin 57°$

$= 28305.13$ m^2

Area of $\Delta BCD = \frac{1}{2}(215)(250) \sin 67°$

$= 24738.57$ m^2

Area of quadrilateral $ABCD$

$= 28305.13 + 24738.57$

$= 53044$ m^2

7. (a) $\angle BOC = 96°$

(b) $\angle DEC = 42°$

(c) $\angle EDB = 70°$

(d) $\angle EBD = 20°$

(e) ΔEPD is similar to ΔBPC

(f) $BC = 8\frac{8}{9}$

8. (a) $\theta = \frac{\pi}{3}$

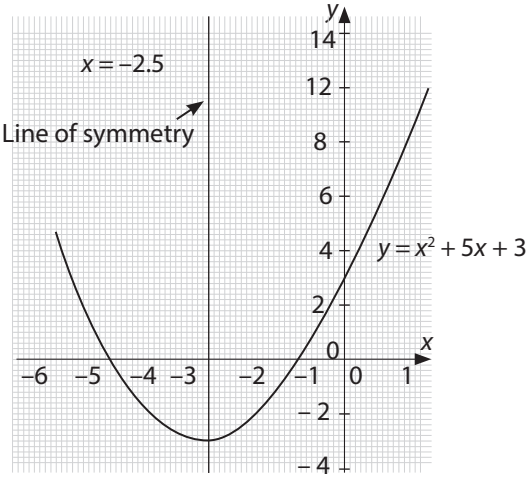
(b) $s = \frac{10\pi}{3}$

(c) (i) 52.4 cm^2

(ii) 30.2 cm^2

9. (a) $a = -3, b = -1$

(b)



(c) $x = -4.30$ or $x = -0.70$

(d) $y = -3.25$

(e) $x = -2.5$

Examination Paper 7

1. (a) $\frac{3a^2c^3}{b^3}$

   (b) $(m^3n^{-4})^{\frac{1}{2}}5m^{-2}n^2 = \frac{5}{m^{\frac{1}{2}}}$

   $= \frac{5}{m^{\frac{1}{2}}}$

2. (a) $3\frac{3}{4} \le x < 11$

   (b) $x = 5, 7$

3. (a) Positive

   (b) Negative

   (c) Zero

4. (a) 4 : 5

   (b) 5.12 kg

5. (a) $\frac{\Sigma fx}{\Sigma f} = 2$

   (b) 60°

   (c) 5

6. (a) $\frac{VC}{12} = \frac{6}{9}$

   $VC = 8$

   (b) $VA^2 = 9^2 + 12^2$

   VA = 15

   $\pi rl = \pi \times 9 \times 15 = 135\pi = 424\ \text{cm}^2$

7. (a) $\cos 40° = \frac{8}{KM}$

   $KM = \frac{8}{\cos 40°}$

   = 10.443 cm

   = 10.4 cm

   (b) $\tan 40° = \frac{LM}{8}$

   $LM = 8 \tan 40°$

   = 6.7128 cm

   = 6.71 cm

   (c) $\frac{1}{2} \times 8\ \text{KT} \sin 40° = 17.9$

   $\text{KT} = \frac{17.9}{4 \sin 40°}$

   KT = 6.9619

   KT = 6.96 cm

8. Bank A:

   Simple interest $= \frac{20\,000 \times 3 \times 5}{100}$

   = 3000

   Total amount = 20 000 + 3000

   = $23 000

   Bank B:

   $A = 20\,000\left(1 + \frac{\frac{2.4}{4}}{100}\right)^{20}$

   = $22 541.85

   Jane should put her money in Bank A because the total amount will be greater in this bank.

9. (a) $2x(2x + y)(2x - y)$

   (b) $y(a - k)(b - x)$

   (c) $x = 2.769$ or -0.602

10. (a) Bearing of B from $A = 042°$

    (b) Bearing of A from B

    $= 180° + 42°$

    $= 222°$

    (c) Area of major sector $CBED$

    $= \frac{290}{360} \times \pi \times 100^2$

    $= 25307$

    $= 25300\ \text{m}^2$

    (d) Arc length BFD

    $= \frac{70}{360} \times 2\pi \times 100 = 122.173$

    $= 122\ \text{m}^2$

11. (a) 2

    (b) Gradient of $AC = 2$

    $y = 2x - 2$

    (c) (0, –2)

12. (a) 25°

    (b) 65°

    (c) 106°

    (d) 25°

    (e) 37°

13. (a) (i) $A = \{2, 3, 5, 7, 11, 13, 17, 19, 23, 29\}$

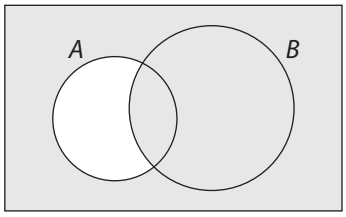
    (ii) $B = \{3, 6, 9, 12, 15, 18, 21, 24, 27\}$

    (iii) $A \cap B = \{3\}$

(b) $B \cap C = \{ 3, 6, 9, 12, 15, 18 \}$

$n (B \cap C) = 6$

(c) ξ



14. (a) $21a - 14b = 5a + 10b$

$16a = 24b$

$2a = 3b$

$\frac{a}{b} = \frac{3}{2}$

(b) $\frac{3}{x-2} + \frac{8}{x^2-4}$

$= \frac{3}{x-2} + \frac{8}{(x+2)(x-2)}$

$= \frac{3(x+2)+8}{(x+2)(x-2)}$

$= \frac{3x+14}{(x+2)(x-2)}$

15. (a) $20 - 11n$

(b) $20 - 11(57) = -607$

(c) $20 - 11n = -55$

$n = 6\frac{9}{11}$ (not a positive integer)

16. (a) The axis does not start from zero.

(b) It may cause people to think that the percentage of respondents who likes ZPhone is 3 times more than the percentage of respondents who likes MoonPhone.

17. (a) $(-6, 0)$

6

(b) $(0, 12)$

(c) $x = -2$

(d) $\sqrt{148}$ or 12.2

(e) $12 + 2 + 12.2 = 26.2$ units

Examination Paper 8

1. (a) (i) May (simple interest/hire purchase)

Balance payment $= 0.8 \times 62500 =$ \$50000

Total bank loan $= 50000 + 6750 =$ \$56750

Monthly instalments

$= 56750 \div 36$

$=$ \$1576.388888

$=$ \$1576 (nearest \$)

(ii) Eric (compound interest)

Balance payment

$= 62\,500 - 35\,000 =$ \$27500

$= \$27\,500\left(1 + \frac{3.5/2}{100}\right)^6$

$=$ \$30 516.81

Cost of new car

$= 35\,000 + 30516.81$

$=$ \$65 516.81 (nearest ¢)

(b) Cost of property $= 2450 \times 250$

$=$ US\$61 2500

Property tax in US\$ $= 0.05 \times 612\,500$

$=$ US\$30 625

Property tax in S\$ $= 30\,625 \times 1.55$

$=$ S\$47 468.75

(c) Chargeable income $= 43430 - 6930$

$=$ \$36500

Income tax payable

$= 375 + (6500 \times 5.50\%)$

$= 375 + 357.50 =$ \$732.50

2. (a) $FD = 100 \times \sin 28°$

$= 46.9472 = 46.9$

(b) $BC = \sqrt{100^2 - 46.9472^2} = 88.2948 = 88.3$

(c) $AC = \sqrt{88.2948^2 + 88.2948^2} = 124.8677$

$= 125$

(d) $\angle EAC = \tan^{-1}\left(\frac{46.9472}{124.8677}\right) = 20.6°$

(e) $\angle EXB = \tan^{-1}\left(\frac{100}{\frac{1}{4} \times 88.2948}\right) = 77.6°$

3. (a) $\frac{4}{2f-3}+\frac{2}{2f-3}$

$=\frac{6}{2f-3}$

(b) $pq+2p=3q-r$

$pq-3q=-2p-r$

$q(p-3)=-2p-r$

$\therefore q=\frac{-2p-r}{p-3}$

(c) (i) $(x-3)^2-28$

(ii) $x^2=6x+19$

$(x-3)^2=28$

$x-3=\pm\sqrt{28}$

$\therefore x\approx 8.29$ or $x\approx -2.29$

4. (a) $\angle PXY=\angle PQR$ (corr. $\angle$s, XY // QR)

$\angle PYX=\angle PRQ$ (corr. $\angle$s, XY // QR)

$\angle P$ is a common $\angle$.

ΔPYX and ΔPQR are similar (AAA-similarity)

(b) ΔRQA

(c) (i) $QR=15$ cm

(ii) $PX=15$ cm

(iii) 9 : 16

5. (a) By similar triangles:

$\frac{XB}{XB+2}=\frac{2}{6}$

$XB=1$

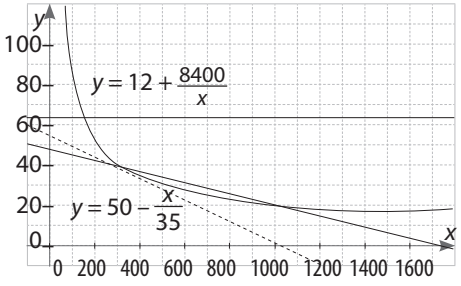
(b) (i) 224 cm^3

(ii) $VC=1.41$ cm

$VD=4.24$ cm

(iii) 196 cm^2

6. (a)



(b) No. of toys = 160 (±10)

(c) Tangent at $x=400$

Gradient = −0.05 (±0.01)

(d) (i) Graph of $y=50-\frac{x}{35}$

(ii) 280 (±10) ≤ x ≤ 1050 (±10)

7. (a) (i) $\angle ODC=\angle OCD=38°$

(base $\angle$s of isos. Δ)

$\angle DCB=90°$ ($\angle$ in semicircle)

$\angle DBC=180°-90°-38°$

($\angle$ sum of Δ)

$=52°$

(ii) $\angle BOC=2\angle ODC$

$=2(38°)$

$=76°$

($\angle$ at centre = 2$\angle$ at circumference)

(iii) $\angle ABO=\angle BOC=76°$

(alt. $\angle$, AB // OC)

$\angle BAD=90°$ (angle in semicircle)

$\angle ADB=180°-90°-76°$

$=14°$ ($\angle$ in same segment)

(b) (i) ΔBFG is similar to ΔBOC (AA)

$\frac{\text{Area of }\Delta BFG}{\text{Area of }\Delta BOC}=\left(\frac{3}{10}\right)^2$

$\frac{30}{\text{Area of }\Delta BOC}=\left(\frac{3}{10}\right)^2$

Area of $\Delta BOC=333\frac{1}{3}$

Area of $OFGC=333\frac{1}{3}-30=303\frac{1}{3}$

(ii) $\frac{\text{Area of }\Delta BFG}{\text{Area of }\Delta BFC}=\frac{\frac{1}{2}\times 3\times h}{\frac{1}{2}\times 10\times h}$

$\frac{30}{\text{Area of }\Delta BFC}=\frac{3}{10}$

Area of $\Delta BFC=100$ cm^2

8. (a) (i) $= \frac{4}{3}$

$= \frac{4}{3}$

$4\theta = \frac{3\pi}{2} - 3\theta$

$7\theta = \frac{3\pi}{2}$

$\theta = \frac{3\pi}{14}$

(ii) Area of $\Delta OPQ = \frac{1}{2} \times 15^2 \times \sin\left(\frac{2\pi}{7}\right)$

$= 87.956 \text{ cm}^2$

Area of sector $OQR = \frac{1}{2} \times 15^2 \times \frac{3\pi}{14}$

$= 75.735 \text{ cm}^2$

Area of shaded region

$= 87.956 + 75.735$

$= 163.691 \text{ cm}^2$

$\approx 163.7 \text{ cm}^2$

(b) $\frac{616}{60 \times 60} = \frac{77}{450}$

9. (a) $x = 6$

(b) $x = -10$

(c) (i) Volume $= z^{\frac{5}{9}} \text{ m}^2$

(ii) $z^{\frac{5}{9}} = (2^6)^{\frac{5}{9}} = (\sqrt[3]{2})^{10} \text{ m}^2$

Examination Paper 9

1. \$45
2. $x = -6, y = 0$
3. (a) Cost price $= \frac{100}{112} \times \$2436 = \$2175$

(b) $\frac{105}{100} \times \frac{115}{100} \times \$64 = \$77.28$

4. Black more common because more students have black hair. Otherwise M1 for either 12 or 15 seen, or 0.3×40 or $\frac{3}{8}$ (40) seen.

5. (a) $\left(\frac{5}{2}\right)^{-3} \times 9^0 \div \left(\frac{8}{5}\right)$

$= \left(\frac{2}{5}\right)^3 \times 1 \times \left(\frac{5}{8}\right)$

$= \frac{1}{25}$ or $= 0.04$

(b) $\frac{8x^5}{a^5y}$

6. (a) $100 - 64 = 36$, $\sqrt{36} = 6$ (Pythagoras' theorem)

(b) (i) $\frac{4}{5}$ (ii) $-\frac{3}{5}$

(iii) $\frac{3}{4}$

Penalise 1 mark if all 3 not expressed in lowest term

7. Misleading: Appears as if the number of students in 2021 is double from that in 2017.

Suggestion: Vertical axis to start from 0.

8. (a) (i) Mode $= 15 < x \leq 20$

(ii) Mean $= 26.07 \approx 26.1$ min

(iii) Standard deviation $= 7.34$ min

(b) Mean gives the best representation of the average time taken.

Because the frequency is well-spread (and the standard distribution is small).

9. (a) $x = 1.5$

(b) $Y = -0.5$

10. $x - 6 \leq 5x + 3$

$x - 5x \leq 3 + 6$

$-4x \leq 9$

$x \geq -\frac{9}{4}$

$x \geq -2\frac{1}{4}$

$4x - 1 > 6x - 5$

$4x - 6x > -5 + 1$

$-2x > -4$

$x < 2$

Greatest $x = 1$

Smallest $x = -2$

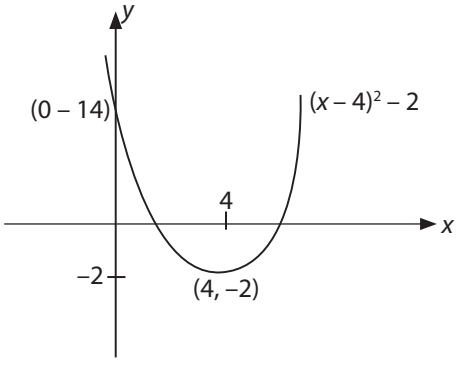
11. (a) $AC^2 = 34^2 + 27^2 - 2(34)(27)\cos 102°$
$AC = 47.61 \approx 47.6$ km

(b) $\frac{27}{\sin \angle BAC} = \frac{47.61}{\sin 102°}$
$\angle BAC = 33.69°$
Bearing of C from $A = 40° + 33.69°$
$= 73.69° \approx 073.7°$
(Deduct $\frac{1}{2}$ mark if answer isn't corrected to 1 d.p. or if not in 3 digit form)

12. (a) 120
(b) 7370

13. (a) $\frac{8}{17}$ (b) $-\frac{3}{5}$

14. $(x-4)^2 - 2$



15. (a) $y \geq 25$
(b) Since median = $35 \leq x < 45$ and y to be the largest possible value,
$12 + 18 + y = 23 + 17$
$y = 10$
(c) Mean = 32.0 years

16. (a) $21^2 - 19^2 = 4(21 - 1) = 8(10) = 80$
(b) 3402 is not a multiple of 8

17. (a) $56 + 10(5) - (5)^2 = 81$
(b) $56 = 56 + 10x - x^2$
$x^2 - 10x - 0$
$x(x - 10) = 0$
$x = 0$ or $x = 10$
$x = 10$
(c) $h = 0$
$56 + 10x - x^2 = 0$
$x^2 - 10x - 56 = 0$
$(x + 4)(x - 14) = 0$
$x = 14$

18. (a) The gradient of line l.
Gradient of $AB = \frac{-8-2}{12-(-3)} = -\frac{2}{3}$
(b) The equation of line l.
$2 = -\frac{2}{3}(-3) + c$
$c = 0$
Equation of line: $y = -\frac{2}{3}x$ or $3y + 2x = 0$
(c) The length of BC.
Length $BC = \sqrt{(12-8)^2 + (-8-(-6))^2}$
$= \sqrt{16 + 4}$
$= \sqrt{20}$

19. (a) $p^3 = \frac{q^2 - 1}{r}$
$q^2 - 1 = p^3 r$
$q = \pm p^3 r + 1$ (if no ± sign , deduct $\frac{1}{2}$ mark)
(b) $q = \pm\sqrt{2^3(4) + 1} = \pm 5.74$
(Deduct $\frac{1}{2}$ mark if only 1 answer is given.)

20. $\frac{\frac{3}{2}}{5} = \frac{x}{3}$
$5x = \frac{9}{2}$
$x = \frac{9}{10}$

21. (b) (i) 18 (ii) $\frac{81}{49}$
(iii) $\frac{7}{16}$ (iv) $\frac{81}{256}$

22. (a) $x \leq 13$
(b) No, because there are 6 prime numbers less than or equal to 13 (2, 3, 5, 7, 11, 13).

Examination Paper 10

1. (a) $3 - 3^{3x} = 3^{-2}$

$3 + 3x = -2$

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

(b) $\frac{3x^2 - 1 - 28}{4} = \frac{2x + 9}{2}$

$3x - 29 = 4x + 18$

$x = -47$

(c) $\frac{1}{2-x} + \frac{2x}{(x-3)(x-2)}$

$= \frac{1}{2-x} - \frac{2x}{(x-3)(2-x)}$

$= \frac{x - 3 - 2x}{(2-x)(x-3)}$

$= \frac{-x-3}{(2-x)(x-3)}$

2. (a) $C = \begin{pmatrix} 0.45 & 0.65 & 0.70 \\ 0.22 & 0.40 & 0.25 \end{pmatrix}$

(b) $AC = (1\ 1) \begin{pmatrix} 0.45 & 0.65 & 0.70 \\ 0.22 & 0.40 & 0.25 \end{pmatrix}$

$= (0.45 + 0.22\ 0.65 + 0.40\ 0.70 + 0.25)$

$= (0.67\ 1.05\ 0.95)$

(c) Total cost for each type of noodles. / Total cost of each bowl of different types of noodles.

(d) $\begin{pmatrix} 300 \\ 180 \\ 240 \end{pmatrix}$

(e) $CN = \begin{pmatrix} 0.45 & 0.65 & 0.70 \\ 0.22 & 0.40 & 0.25 \end{pmatrix} \begin{pmatrix} 300 \\ 180 \\ 240 \end{pmatrix} = \begin{pmatrix} 420 \\ 198 \end{pmatrix}$

(f) Cost of ingredients and labour respectively for all types of noodles sold in one day.

3. (a) (i) Bearing of M from K

$= 050° + 065°$

$= 115°$

(ii) $\frac{JM}{\sin 65°} = \frac{0.6}{\sin 50°}$

$JM = 0.7098$

$= 0.710$ km

(iii) $LM^2 = 1.3^2 + 0.6^2 - 2(1.3)(0.6)\cos(180° - 65°)$

$LM = 1.645$

$= 1.65$ km

(b) (i) Area of KLM

$= \frac{1}{2}(1.3)(0.6)\sin(180° - 65°)$

$= 0.3534$

$= 0.353\ km^2$

(ii) $\frac{1}{2} \times 1.645 \times h = 0.3534$

$h = 0.4296$

$= 0.430$ km

(c) $\tan\theta = \frac{0.4}{1.3}$

Angle of depression, $\theta = 17.10° = 17.1°$

4. (a) $\begin{pmatrix} 10 & 6 & 12 \\ 7 & 13 & 15 \end{pmatrix} \begin{pmatrix} 15 \\ 28 \\ 30 \end{pmatrix}$

$= \begin{pmatrix} 10 \times 15 + 6 \times 28 + 12 \times 30 \\ 7 \times 15 + 13 \times 28 + 15 \times 30 \end{pmatrix}$

$= \begin{pmatrix} 678 \\ 919 \end{pmatrix}$

(b) 678 litres of Glossy paint and 919 litres of Emulsion paint are used by the company to paint all the shops in Chinatown.

(c) $(2.50\ \ 3.10) \begin{pmatrix} 678 \\ 919 \end{pmatrix}$

$= (678 \times 2.5 + 919 \times 3.1)$

$= (4543.90)$

(d) $(15\ 28\ 30\ 10\ 15\ 40) \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{pmatrix} = (138)$

5. (a) $(x + 2.5)$ km/h

(b) (i) $\frac{5}{x}$h (ii) $\frac{5x+5}{x(x+2.5)}$

(c) $\frac{5}{x} - \frac{5x+5}{x(x+2.5)} = \frac{1}{6}$

$\frac{5(x+2.5) - 5x - 5}{x(x+2.5)} = \frac{1}{6}$

$2x^2 + 5x - 90 = 0$ (shown)

(d) 5.574 or –8.074

(e) (i) 44 min (ii) 6.85 km/h

6. (a) $\frac{168}{x}$

(b) $\frac{168}{x+7}$

(c) $\frac{168}{x} - \frac{168}{x+7} = 2$

$168(x + 7) - 168x = 2x(x+7)$

$168x + 1176 - 168x = 2x^2 + 14x$

$2x^2 + 14x - 1176 = 0$

$x^2 + 7x - 588 = 0$ (shown)

(d) $x^2 + 7x - 588 = 0$

$(x + 28)(x - 21) = 0$

$x = -28$ (reject negative) or $x = 21$

$\frac{168}{x+7} = \frac{168}{21+7} = \$6$

7. (a) $m = \frac{8-(-2)}{-3-2} = -2$

(b) $-2 = -2(7) + c$

$c = 14 - 2 = 12$

$\rightarrow y = -2x + 12$

(c) Area of $\Delta ABC = \frac{1}{2} \times 5 \times 10 = 25$ units^2

(d) $AC = \sqrt{[8-(-2)]^2 + (-3-7)^2}$

$= \sqrt{200}$

$= 14.1$ units

(e) $\frac{25 \times 2}{\sqrt{200}} = 3.535\,533\,906 = 3.54$ units (3 s.f.)

(f) $D = (2, 8)$

8. (a) $\frac{10560}{y}$

(b) $\frac{14040}{y+2}$

(d) 16 or 11, $y = 11$ is rejected as $y > 15$

Examination Paper 11

1. (a) $\frac{1.49}{0.425 - \sqrt[3]{4512}} = -0.925\,50\ldots$

≈ -0.093

(b) (i) $67.5\% = 67\frac{1}{2} \times \frac{1}{100} = \frac{27}{40}$

(ii) $\frac{5}{17} = 0.20411\ldots \approx 0.294$

2. (a) $3x, x^2, \sqrt{x}, \frac{1}{x}, -4x$

(b) (i) 15 (ii) $-\frac{49}{2}$

3. (a) $V_1 = \frac{4}{3}\pi(2r)^3 = 8V$

Answer : 700%

(b) 10 men $\rightarrow$ 45 days

1 man $\rightarrow$ 450 days

6 men $\rightarrow \frac{450}{6} = 75$ days

4. (a) $y = \frac{1}{2}x - 6$

(b) Gradient of $AB = \frac{q-(-6)}{-2-4}$

$= \frac{q+6}{-6}$

$\frac{q+6}{-6} = \frac{1}{2}$

$2(q + 6) = -6$

$2q + 12 = -6$

$q = -9$

(c) Length of $AB = \sqrt{(4+2)^2 + (-6+9)^2}$

$= \sqrt{45}$

$= 6.71$units

5. (a) When $x = 0, y = -9$

$B\,(0, -9)$

When $y = 0, x = -1\frac{1}{2}$ or 3

$A(-1\frac{1}{2}, 0)$

(b) Line of equation: $x = \frac{-1\frac{1}{2}+3}{2} = \frac{3}{4}$

(c) Area of ΔBAC

$= \frac{1}{2}(AC)$ ($\perp$ heigth)

$= \frac{1}{2}(4\frac{1}{2})(9)$

$= 20.25$ units^2

(d) Gradient of $BC = \frac{0+9}{3-0} = 3$

Equation is $y = 3x - 9$

6. (a) $6b^{a+4} + 3b^{a+2} - 9b^{a+3}$

$= 3b^{a+2}(2b^2 + 1 - 3b)$

$= 3b^{a+2}(2b^2 - 3b + 1)$

$= 3b^{a+2}(2b-1)(b-1)$

(b) $5^{4p-2q+3r}$

$= \frac{(5p)^4 \times (5r)^3}{(5^q)^2}$

$= \frac{4^4 \times 7^3}{10^2}$

$= \frac{87808}{100}$

$= 8.7808 \times 10^2$

(c) 0.285 picometres

$= 0.285 \times 10^{-12} \times 10^2$ cm

$= 0.285 \times 10^{-10}$ cm

$= 2.85 \times 10^{-11}$ cm

7. (a) (i) $\sqrt{9^{2x-1}} = \left(\frac{1}{3}\right)^x$

$9^{2x-1} = \left(\frac{1}{3}\right)^{2x}$

$3^{2(2x-1)} = 3^{-1(2x)} \quad 3^{2x-1} = 3^{-x}$

$2(2x-1) = -1(2x)$

$2x - 1 = -x$

$4x - 2 = -2x$ or $x = \frac{1}{3}$

$6x = 2$

$x = \frac{1}{3}$

(ii) $\frac{5 \times 2^{x+2} - 2^{x+1}}{3 \times 2^x} = \frac{5 \times 2^x \times 2^2 - 2^x \times 2^1}{3 \times 2^x}$

$= \frac{2^x(5 \times 2^2 - 2^1)}{3 \times 2^x}$

$= \frac{5 \times 2^2 - 2^1}{3}$

$= \frac{18}{3}$

$= 6$

(b) $\frac{1}{x+2} - \frac{1}{2x-1} = \frac{2x-1-(x+2)}{(x+2)(2x-1)}$

$= \frac{2x-1-x-2}{(x+2)(2x-1)}$

$= \frac{x-3}{(x+2)(2x-1)}$

8. $\frac{3}{4}x + y - 4 = 0$

$y = 4 - \frac{3}{4}x \ldots (1)$

$\frac{1}{3}x - 2y = 14 \ldots (2)$

Substitute (1) into (2):

$\frac{1}{3}x - 2\left(4 - \frac{3}{4}x\right) = 14$

$\frac{1}{3}x - 8 + \frac{3}{2}x = 14$

$1\frac{5}{6}x = 22$

$x = 12$

Using (1), $y = 4 - \frac{3}{4}(12) = -5$

9. (a) 37.6

(b) 32.5

(c) There is an outlier of age 81 years, which is 18 years older than the next oldest person, which causes the mean age to be raised significantly.

(d) 16.1

(e) The difference in ages in the finance department is smaller due to the smaller spread in the age distribution of the department.

10. (a) $\sin \angle ACD = \sin \angle ACB$

$= \frac{4}{5} = 0.8$

(b) $\sin \angle ADC = \sin \angle ADB$

$= \frac{4}{8} = 0.5$

(c) $(3 + CD)^2 = 8^2 - 4^2$

$3 + CD = \sqrt{64 - 16}$

$CD = 3.928 \approx 3.93$ cm

11. (a) Bearing of A from $D = 180° + 30° = 210°$

(b) Bearing of C from $B = 065°$

12. (a) Original selling price $= \frac{33.81}{92} \times 100$

$= \$36.75$

(b) $0.15(x - 35) = 27.47 + 0.07\,(x)$

$0.15x - 5.25 = 27.47 + 0.07x$

$0.08x = 32.72$

$x = 409$ eggs

(c) Let the number of 5-cent coins be x.
The number of 50-cent coins will be $21 - x$.

$5x + 50(21 - x) = 375$

$5x + 1050 - 50x = 375$

$45x = 675$

$x = 15$

13. (a) $\begin{pmatrix} 1 & 2 \\ 4 & 10 \end{pmatrix}\begin{pmatrix} 5 & -1 \\ -2 & k \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

$-1 + 2k = 0$

$k = \frac{1}{2}$

(b) $p^2 = \begin{pmatrix} 1 & 2 \\ 4 & 10 \end{pmatrix}\begin{pmatrix} 1 & 2 \\ 4 & 10 \end{pmatrix} = \begin{pmatrix} 9 & 22 \\ 44 & 108 \end{pmatrix}$

$\left(1 - \frac{1}{2}\right)\begin{pmatrix} 9 & 22 \\ 44 & 108 \end{pmatrix} = (-13\ -32)$

14. $p = \frac{k}{2q - 3}$

$k = 6$

When $q = 6$, $p = \frac{6}{9} = \frac{2}{3}$

15. (a) $\angle DCB = 70 - 40 = 30°$ (ext. $\angle$ of Δ)

(b) $\angle ACB = 90°$ ($\angle$ in a semicircle)

$\angle DCA = 90 - 30 = 60°$

(c) $\angle BAC = 180 - 70 - 60 = 50°$ ($\angle$ sum of Δ)

(d) $\angle DOB = 2\angle DCB = 60°$ ($\angle$ at centre = 2$\angle$ at circumference)

(e) $\angle ODB = \frac{180 - 60}{2} = 60°$ (base $\angle$s of isos. Δ)

(f) $\angle ODB = \angle OBD = 60°$ (isos. Δ, $OD = OB$)

$\angle CDB = 180° - 30° - 40° - 60° = 50°$ ($\angle$ sum of Δ)

16. (a) $\angle BCO = \pi - \angle BOC - \angle OBC$

$= \pi - 0.7 - 0.7$

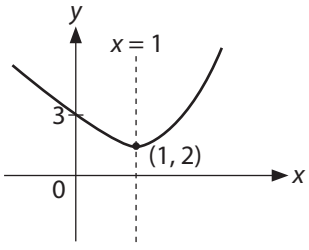
$= 1.74$ rad

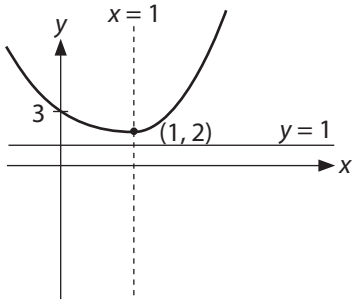
(b) $14.3\ cm^2$

17. (a) $\frac{1}{y}$

(b) $-\frac{1}{y}$

18.





Since the line $y = 1$ does not intersect the graph of $y = (x - 1)^2 + 2$, the equation has no real solution.

Examination Paper 12

1. (a) $\frac{45}{x}$

(b) $\frac{45}{x - 5}$

(d) 16.1 or −11.1

(e) 6.85 h

2. (a) $\frac{TR}{60} = \tan 28°$

$TR = 31.9$ m

(b) $\sin \angle PQR = \frac{60}{90}$

$\angle PQR = 41.8°$

(c) Angle of depression of P from $T = 28°$

$\tan \angle TQR = \frac{TR}{RQ} = \frac{31.9}{90}$

$\angle TQR = 19.5°$

Angle of depression of Q from $T = 19.5°$

3. (a) $\frac{50}{x}$

(b) $\frac{6}{x-16}$

(d) 17.9, 7.46 (rej)

(e) 3 h

4. (a) (i) $\angle ABC = \angle ADC$ (given)

$\angle A$ is common

Hence $\angle ABD = \angle ACB$

$\Delta ABD = \angle ACB$ are similar

$\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta ABD} = \frac{64}{16}$

(ii) $\frac{AB}{AD} = \sqrt{\frac{64}{16}}$

$\frac{AB}{5} = \frac{8}{4}$

$= 2$

$AB = 10$ cm

(iii) $AC = 2 \times AB$

$AC = 2 \times 10$

$AC = 20$ cm

(b) (i) $\angle BTF = 90° - 35° = 55°$

$\tan 55° = \frac{6.4}{TF}$

$TF = \frac{6.4}{\tan 55°}$

$TF = 4.4813$

$TF \approx 4.48$ m

(b) (ii) $\angle ATF = 55° + 7°$

$ATF = 62°$

$\tan 62° = \frac{AF}{4.4813}$

$AF = 8.43$ m

(iii) $6.4 + AB = 4.4813 \tan 62°$

$AB = 2.0281$

$AB \approx 2.03$m

5. (a) \$4916.59

(b) \$99136

(c) \$498.98

6. (a) $m_{AC} = \frac{7-1}{0-9} = -\frac{2}{3}$

Equation of AC is $y = -\frac{2}{3}x + 7$

(b) Sub $x = 3$, $y = -\frac{2}{3}(3) + 7 = 5$

Sub $x = 3$, $B = (3, 5)$

Sub $x = 3$, $E = (9, 0)$

(c) Length of $AB = \sqrt{(9-3)^2 + (1-5)^2}$

Length of $AB = 7.21$ units

7. (a) $m = 34.8$

(c) 1.65, 5.5

(d) 1.7, 7.55

(e) 14.4

(f) 2.94

8. (a) $\begin{pmatrix} 30 & 45 & 20 & 4 \\ 40 & 20 & 60 & 6 \\ 50 & 0 & 65 & 40 \end{pmatrix} \begin{pmatrix} 5 \\ 10 \\ 20 \\ 30 \end{pmatrix}$

(b) (i) $(18\ 12\ 9) \begin{pmatrix} 30 & 45 & 20 & 4 \\ 40 & 20 & 60 & 6 \\ 50 & 0 & 65 & 40 \end{pmatrix}$

(ii) (1470 1050 1665 504)

(iii) 1050

(c) \$55075.50

9. (a) $m = 4$

(b) 1 : 4

(c) D = (3, 19)

(d) 30

Examination Paper 13

1. (a) (i) $\frac{1}{\sqrt{25}} - \frac{1}{\sqrt{27}} = \frac{1}{5} - \frac{1}{3} = -\frac{2}{15}$

   (ii) 4.15

   (b) Radius = 5×10^{-9} m or 5 nanometres

   Vol = $\frac{4}{3}\pi(5 \times 10^{-9})^3 = 5.24 \times 10^{-25} m^3$

2. (a) $C = \frac{5}{9}(F - 32)$

   $\frac{9}{5}C = F - 32$

   $F = \frac{9}{5}C + 32$

   (b) $F = \frac{9}{5}C + 32$

   $= \frac{9}{5}(37.5) + 32$

   $= 99.5°$ F

3. (a) (i) $450 = 2 \times 3^2 \times 5^2$

   (ii) LCM = $2^3 \times 3^2 \times 5^2$

   (b) $24n = 2^3 \times 3 \times n$

   $n = 3^2$

   $= 9$

4. (a) $\frac{\text{Curved surface area of smaller vase}}{\text{Curved surface area of larger vase}} = \frac{16}{25}$

   $\frac{\text{Curved surface area of smaller vase}}{645} = \frac{16}{25}$

   Curved surface area of the smaller vase

   $= \frac{16}{25} \times 645$

   $= 412\frac{4}{5}$ or 412.8 cm^2

   (b) $\frac{A_1}{A_2} = \frac{16}{25} \rightarrow \sqrt{\frac{16}{25}} = \frac{4}{5}$

   $\frac{m_1}{m_2} = \frac{V_1}{V_2} = \left(\frac{l_1}{l_2}\right)^3 \rightarrow \frac{m_1}{m_2} = \left(\frac{4}{5}\right)^3 = \frac{64}{125}$

   $\rightarrow \frac{4.8}{m_2} = \frac{64}{125}$

   $\rightarrow m_2 = \frac{125}{64} \times 4.8 = 9.375$ kg

5. (a) Actual length = 50000×3.2

   = 160000 cm

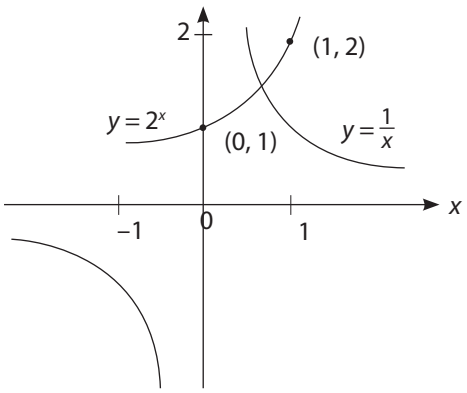
   = 1.6 km

   (b) 1 : 0.5 km

   1 cm^2 : 0.25 km^2

   Area on map = $\frac{1}{0.25} \times 3.5 = 14$ cm^2

6. (a) & (b)



7. (a) $y = x^2 - 6x + 4$

   $= (x - 3)^2 - 3^2 + 4$

   $= (x - 3)^2 - 5$

   (b) (3, −5)

   (c) It is a minimum point.

   The coefficient of x^2 is positive.

8. (a) −25 (b) 4

9. (a) (i) $5x - 7 \le \frac{\pi}{2} + 13 \le 9x + 5$

   $5x - 7 \le \frac{\pi}{2} + 13$ $\frac{\pi}{2} + 13 \le 9x + 5$

   $4\frac{1}{2}x \le 20$ $8 \le 8\frac{1}{2}x$

   $x \le 4\frac{4}{9}$ $\frac{16}{17} \le x$

   $\therefore \frac{16}{17} \le x \le 4\frac{4}{9}$

   (ii) Prime values = 2, 3

   (b) $6x - 13x = -3y - 2y$

   $-7x = -5y$

   $\frac{x}{y} = \frac{5}{7}$

   The ratio is 5 : 7.

(c) $2x < 5 - 9$

$x < -2$

Since $-4 \le x < -2$, the integers are -4 and -3.

10. (a) $(7x^2y)^0 \div (4x^3) - 1 = 1 \div \frac{1}{4x^3}$

$= 4x^3$

(b) $27^k = 3^{25} \div 81$

$3^{3k} = 3^{25} \div 3^4$

$3k = 25 - 4$

$3k = 21$

$k = 7$

11. (a) $\frac{5}{2-x} - \frac{8x+3}{4x^2-16} = 2$

$\frac{5}{2-x} - \frac{8x+3}{4(x-2)(x+2)} = 2$

$\frac{5}{2-x} - \frac{8x+3}{4[-(2-x)](x+2)} = 2$

$\frac{5(4)(x+2) + 8x + 3}{4(2-x)(x+2)} = 2$

$5(4)(x+2) + 8x + 3 = 2(4)(2-x)(x+2)$

$20x + 40 + 8x + 3 = 32 - 8x^2$

$8x^2 + 28x + 11 = 0$

$x = \frac{-28 \pm \sqrt{28^2 - 4(8)(11)}}{2(8)}$

$x = \frac{-28 \pm \sqrt{432}}{16}$

$x = -3.05$ or -0.45 (2d.p.)

12. (a) $2a^2 - 18b^2 = 2(a^2 - 9b^2)$

$= 2(a - 3b)(a + 3b)$

(b) $3x^2 + 19x - 14 = (3x - 2)(x + 7)$

13. (a) $2C = A + 2B$

$2C = \begin{pmatrix} 4 & 12 \\ -4 & 4 \end{pmatrix}$

$C = \frac{1}{2}\begin{pmatrix} 4 & 12 \\ -4 & 4 \end{pmatrix}$

$= \begin{pmatrix} 2 & 6 \\ -2 & 2 \end{pmatrix}$

(b) (i) $\begin{pmatrix} -5 & 6 \\ -4 & -5 \end{pmatrix}$

(ii) $\begin{pmatrix} -3 & 15 \\ -8 & -2 \end{pmatrix}$

(iii) $\begin{pmatrix} 90 \\ 0 \end{pmatrix}$

(c) $k = 2$

14. (a) 2 cm

(b) $x = 10$ cm^2

(c) $x = 4.5$ cm

15. $AD = CD$ (equal sides of a rhombus), DE is a common side, $\angle ADE = \angle CDE$ (Diagonal BD bisects $\angle ADC$)

$\therefore \Delta ADE$ and ΔCDE are congruent (SAS)

16. (a) $-\frac{2}{3}$

(b) $A(0, 5)$, $B(7.5, 0)$

(c) $x = 7.5$

17. (a) 33.5 m

(b) 27.1 m

18. (a) 21.7 m

(b) 022°

(c) 7.06 m

19. (a) $1 + 2^2 = (1 + t)^2$

$1 + t = \sqrt{5}$ or $-\sqrt{5}$ (N.A.)

$t = \sqrt{5} - 1 \approx 1.24$

(b) $\tan \angle BCA = \frac{2}{1}$

$\angle BCA = 63.4349° \approx 63.4°$

(c) $\angle DEB = \frac{1}{2}(360° - 63.4349°) \approx 148.3°$

($\angle$ at centre = 2 × $\angle$ at circumference)

20. (a) $T_1 = 40$

$T_2 = 33$

$T_3 = 26$

(b) n^{th} term $= 47 - 7n$

Examination Paper 14

1. (a) $m = 0$ (b) $x = 9$

   (c) Area of $\Delta ABC = \frac{1}{2} \times 11 \times 10.5$

   $\Delta ABC = 57.75$ units^2

   (d) $AC = \sqrt{[9 - (-2)]^2 + (-1\frac{1}{2} - 9)^2}$

   $AC = 15.21$ units

   (e) $\frac{1}{2} \times 15.21 \times h = 57.75$

   $h = 7.59$ units

   (f) D = (9, 9)

2. (a) $\frac{50}{p}$ h

   (b) $\frac{50}{p-8}$ h

   (c) $\frac{50}{p-8} - \frac{50}{p} = \frac{40}{60}$

   $\frac{50p - 50(p-8)}{p(p-8)} = \frac{2}{3}$

   $3(400) = 2(p^2 - 8p)$

   $600 = p^2 - 8p$

   $p^2 - 8p - 600 = 0$ (shown)

   (d) $p = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(-600)}}{2(1)}$

   $= \frac{8 \pm \sqrt{2464}}{2}$

   $= 28.819$ or -20.819

   (e) $\frac{50}{28.819 - 8} = 2.40165$ h

   = 2 h 24 min 06 s

3. (a) (i) 65° (ii) 65°

   (iii) 25° (iv) 50°

   (b) 20.4 cm

4. (a) $\frac{168}{x}$

   (b) $\frac{168}{x+7}$

   (c) $\frac{168}{x} - \frac{168}{x+7} = 2$

   $168(x + 7) - 168x = 2x(x + 7)$

   $168x + 1176 - 168x = 2x^2 + 14x$

   $2x^2 + 14x - 1176 = 0$

   $x^2 + 7x - 588 = 0$ (shown)

   (d) $x^2 + 7x - 588 = 0$

   $(x + 28)(x - 21) = 0$

   $x = -28$ (reject negative) or $x = 21$

   $\frac{168}{x+7} = \frac{168}{21+7} = \$6$

5. (a) $\frac{8640}{108\,000} \times 100\% = 8\%$

   (b) (i) \$16200

   (ii) Total Instalment = \$1713.60 × 60

   = \$102816 Interest = \$(102816 − 91800) = \$11016

   $\frac{91800 \times p \times 5}{100} = \$11016$

   $p = 2.4$

   (c) Balance = \$105000

   Total amount $= 105000\left(1 + \frac{\frac{9.5}{12}}{100}\right)^{(3 \times 12)}$

   = \$139468.41

   Interest = \$ 34468.41

   (d) $\frac{7}{107} \times 108000 = \$7065.42$

6. (a) (i) $2x + 3y + 11 = 0$ …(1)

   $2y + 5 = x$ …(2)

   Sub (2) into (1):

   $2(2y + 5) + 3y + 11 = 0$

   $4y + 10 + 3y + 11 = 0$

   $7y = -21$

   $y = -3$

   $y = -3$

   $x = -1$

   (ii) $2y + 4x = 1$

   $y = -2x + 0.5$

   Eqn of new line: $y = -2x + c$ …3

   Sub (2, 5) into (3):

   $5 = -2(2) + C$

   $c = 9$

   $y = -2x + 9$

(b) Gradient of $AC = \frac{10-0}{0-8}$

$= -\frac{5}{4}$

Equation of AC:

$y = -\frac{5}{4}x + C$

Sub (8, 0) into 1:

$0 = \frac{5}{4}(8) + C$

$C = 10$

$y = -\frac{5}{4}x + 10 \ldots 1$

Gradient of $BC = \frac{5-0}{10-0}$.

$= \frac{1}{2}$

Equation of BC:

$y = -\frac{1}{2}x + C$

Sub (0, 0):

$C = 0$

$y = \frac{1}{2}x \ldots 2$

[1] = [2]:

$\frac{1}{2}x = -\frac{5}{4}x + 10$

$\frac{1}{2}x + \frac{5}{4}x = 10$

$\frac{7}{4}x = 10$

$x = \frac{40}{7}$

$y = \frac{1}{2}(\frac{40}{7})$

$y = \frac{20}{7}$

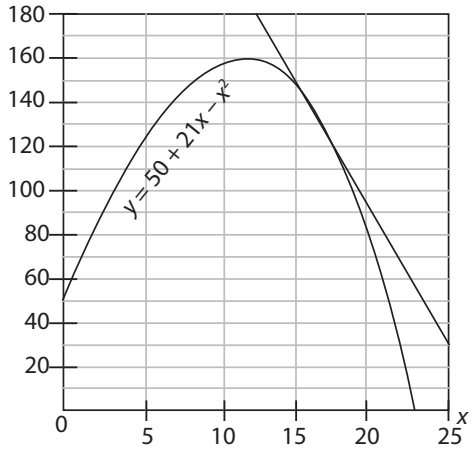
7. (a) $\begin{pmatrix} 18 & 10 & 8 \\ 10 & 17 & 11 \\ 22 & 16 & 9 \end{pmatrix}$

(b) $E = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$

(c) $DE = \begin{pmatrix} 18 & 10 & 8 \\ 10 & 17 & 11 \\ 22 & 16 & 9 \end{pmatrix}\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 36 \\ 38 \\ 47 \end{pmatrix}$

(d) The matrix F represents the total sales of each brand of peanut of shops A, B and C.

8. (a)



(b) (i) Maximum value = 160

(ii) When $x = 6$, $y = 140$

(c) When $x = 16$, gradient $= \frac{60}{-5.5} = -10.9$

9 (a) (i) \$6112 (ii) 56.7%

(b) (i) \$75 (ii) \$2950.60

(c) 1575

Examination Paper 15

1. (a) 0.0006295

(b) 4.40×10^6

2. (a) (i) $450 = 2 \times 3^2 \times 5^2$

(ii) LCM $= 2^3 \times 3^2 \times 5^2$

(b) $24n = 2^3 \times 3 \times n$

$n = 3^2$

$n = 9$

3. (a) $\frac{8 \times 10^{-6}}{2 \times 10^{-7}}$

$= \frac{80 \times 10^{-7}}{2 \times 10^{-7}}$

$= 40$

(b) $8 \times 10^{-6} \times 10^6$

$= 8$ g

$= 0.008$ kg

$= 8 \times 10^{-3}$ kg

4. Bank P $= \frac{90\,000 \times 2.45 \times 5}{100}$

   $= \$11\,025$

   Bank Q $= 90\,000(1 + \frac{2.22}{\frac{12}{100}})^{12\times 5} - 90\,000$

   $= \$10\,555.2293$

   He should borrow from Bank Q because he incurs a lower interest.

5. (a) (i) Greatest possible value of $\frac{y}{x^2} = \frac{8}{(-1)^2} = 8$

   (ii) Least possible value of $x^2 - 2xy + y^2$

   $= (x - y)^2 = (-1 - 2)^2 = 9$

   (b) $-1\frac{1}{2} \le x < 4$

   (c) $x = -1, 0, 1, 2, 3$

6. (a) $A + B = \begin{pmatrix} 27 \\ 78 \\ 34 \end{pmatrix}$

   (b) $(48 \;\; 4 \;\; 40)\begin{pmatrix} 27 \\ 78 \\ 34 \end{pmatrix}$

   $= (48 \times 27 + 4 \times 78 + 40 \times 34)$

   $= (2968)$

   $\therefore$ Total cost = \$2968

7. (a) Bearings are always measured clockwise from the North.

   (b) 335°

   (c) 155°

8. (a) AB = EF = 8.3 cm (given)

   $\angle ABC = \angle EFD = 75°$ (given)

   BC = FD = 16 cm (given)

   $\therefore \Delta CAB \equiv \Delta DEF$ (SAS)

   (b) $x = 16, y = 30$ (isos. Δ)

9. (a) $3x + 6y = 8x$

   $6y = 5x$

   $\frac{y}{x} = \frac{5}{6}$

   (b) $(3a)^2 - (5)^2 + 12ab - 20b$

   $= (3a + 5)(3a - 5) + 4b(3a - 5)$

   $= (3a - 5)(3a + 5 + 4b)$

   (c) $v^2 = \frac{u^2 + 2us}{k}$

   $25 = \frac{81 + 18s}{7}$

   $s = 5\frac{2}{9}$

10. (a) $\cos \angle PRS = -\cos \angle PRQ$

    $\cos \; PRS = -\frac{4}{a}$

    (b) Let the foot of the perpendicular from P to QR be T.

    Using Pythagoras' Theorem:

    PT $= \sqrt{a^2 - 4^2}$

    $= \sqrt{a^2 - 16}$

    $\sin \angle PQR = \frac{\sqrt{a^2 - 16}}{a}$

11. (a) $74^2 = 80^2 + 39^2 - 2(80)(39) \cos \angle BAC$

    $\cos \angle BAC = \frac{80^2 + 39^2 - 74^2}{2(80)(39)}$

    $\angle BAC = 66.9°$

    (b) Area of $ABC = \frac{1}{2} \times 80 \times 39 \times \sin 67$

    Area of $ABC \approx 1440$ m^2

    (c) $\tan 4 = \frac{H}{80}$

    $H = 80 \tan 4$

    $= 5.5941$

    $= 5.59$ m

12. (a) \$315

    (b) $\frac{100(y - x)}{y}$

13. $3x + 5y = 85.50$ …(1)

    $4x + 3y = 70$ …(2)

    (1) × 3: $9x + 15y = 256.50$ –– (3)

    (2) × 5: $20x + 15y = 350$ –– (4)

    (4) – (3): $11x = 93.50$

    $x = \$8.50, y = \$12$

14. $\angle OYT = 90°$, TY = 10, $\angle OMY = 90°$

    $\tan \angle TOY = \frac{10}{4}$

    $\angle TOY = 68.199°$

    $\frac{MY}{4} = \sin 68.199°$

    $XY = 2(4 \sin 68.199°)$

    $XY \approx 7.43$ cm

15. (a) $\frac{90}{360} \times 2\pi(2)$

$= 3.1415$

$= 3.14$ cm

(b) $2^2 - \frac{90}{360} \times \pi(2)^2$

$= 0.85840$

$= 0.858$ cm^2

16. (a) $D(m, 4)$

Gradient of line $BD = \frac{2}{3}$

$\frac{4-0}{m-3} = \frac{2}{3}$

$2m - 6 = 12$

$m = 9$

(b) Line AB: $y + 4x = 12$

When $x = 0$, $y = 12 \Rightarrow A(0, 12)$

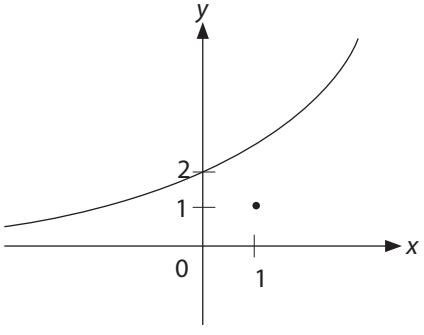
$AB = \sqrt{3^2 + 12^2} = \sqrt{153}$ units

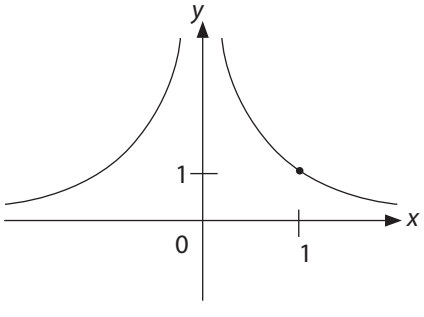
Area of $\Delta ABO = \frac{1}{2}(3)(12)$

$\frac{1}{2}(d)(\sqrt{153}) = \frac{1}{2}(3)(12)$

The shortest distance is 2.91 units. (3 s.f.)

17.





18. $x = 4.70$ or -1.70

19. (a) $y = x^2 - 6x + 4$

$y = (x - 3)2 - 3^2 + 4$

$y = (x - 3)2 - 5$

(b) $(3, -5)$

(c) It is the minimum point. The coefficient of x^2 is positive.

20. (a) Acceleration = gradient of speed–time graph

Acceleration = 1 m/s^2

(b) Distance = area under speed–time graph

$= \frac{1}{2}(10 + 18)(8) = 112$ m

Average speed $= \frac{112}{18} = 6\frac{2}{9}$ m/s

(c) At t = 24s, total distance travelled by lorry

$= 112 + \frac{1}{2}(8 + 18)(6) = 190$ m

Total distance travelled by car

$= 0.5 \times (24 - 8) \times v = 190$

$8v = 190$

$v = 23\frac{3}{4}$ m/s or 23.75

21. (a) 39.5 h

(b) $46 - 31.5 = 14.5$ h

(c) $\frac{39}{50}$

22. Price of 1 gallon in Singapore (in S$)

$= 2.87 \times 3.785$

$= 10.86295$

Price of 1 gallon in Los Angeles (in S$)

$= 8.57 \times 1.39$

$= 11.9123$

Petrol is cheaper in Singapore.

Examination Paper 16

1. (a) $(x-2)(3x+2)=3$

$3x^2+2x-6x-7=0$

$(3x-7)(x+1)=0$

$x=\frac{7}{3}, -1$

(b) $\frac{1-x}{3(x+2)}-\frac{1-2x}{4-x^2}$

$\frac{1-x}{3(x+2)}-\frac{1-2x}{4-x^2}$

$\frac{1-x}{3(x+2)}+\frac{1-2x}{(x+2)(x-2)}$

$\frac{(1-x)(x-2)+3(1-2x)}{3(x+2)(x-2)}$

$\frac{x-2-x^2+2x+3-6x}{3(x+2)(x-2)}$

$\frac{-x^2-3x-1}{3(x+2)(x-2)}$

(c) (i) $x=\frac{-(-4)\pm\sqrt{(-4)^2-4(1)(-b^2)}}{2}$

$x=\frac{4\pm\sqrt{16+4b^2}}{2}$

$x=\frac{4\pm2\sqrt{4+b^2}}{2}$

$x=2\pm\sqrt{4+b^2}$

(ii) $2\pm\sqrt{4+b^2}=a+\sqrt{8}$

$a=2$

$b=2, -2$ (rej)

(d) $\frac{a}{3b}=\frac{2}{3}$

$a=2b$

Sub $a=2b$:

$\frac{2a^2-3b^2}{3a^2-2b^2}$

$=\frac{2(2b)^2-3b^2}{3(2b)^2-2b^2}$

$=\frac{8b^2-3b^2}{12b^2-2b^2}$

$=\frac{1}{2}$

2. (a) $\frac{1}{2}(3x-5)(4x+5)$

(c) $x=-\frac{31}{12}$, 3, 5 cm

(d) \$2314

(e) 8.5 cm^2

3. (a) (i) 5 units $\rightarrow$ 90 litres

3 units $\rightarrow$ 54 litres of orange juice

2 units $\rightarrow$ 36 litres of papaya juice

(ii) 10 units $\rightarrow$ 750 ml

1 unit $\rightarrow$ 75 ml

2 units $\rightarrow$ 150 ml

(iii) 120% $\rightarrow$ \$0.90

100% $\rightarrow$ \$0.75

(iv) 112% $\rightarrow$ \$0.84

Percentage profit $=\frac{0.9-0.84}{0.9}$

$\approx 6.67\%$

(b) (i) $\frac{75}{100}\times 1980 = \$1485$

$I=\frac{PRT}{100}$

$=\frac{1485\times18\times2}{100}$

= \$534.60

(ii) \$1485 + \$534.60 = \$2019.60

$\frac{2019.60}{24}$

= \$84.15

(iii) \$2019.60 + \$495 = \$2514.60

4. (a) $BD=\sqrt{306}\approx 17.5$ cm

(b) $AD=\sqrt{18^2+306-2(18)(17.49)\cos 75}$

$AD=21.61$

(c) $\cos\angle BAD=\frac{306-18^2-21.61^2}{2(18)(21.61)}$

$\angle BAD=\cos^{-1}0.6234$

$\angle BAD=51.4°$

(d) Area of $\Delta BCD=\frac{1}{2}(9)(15)=67.5$ cm^2

Area of $\Delta ABD=\frac{1}{2}(18)(\sqrt{306})\sin 75°$

= 152.07 cm^2

Area $ABCD=219.57\approx 220$ cm^2

5. (a) (i) $\angle BFC=\angle EFD$ (vert opp $\angle$s)

$\angle CBF=\angle DEF$ (alt. $\angle$ s)

$\rightarrow \Delta DEF$ is similar to ΔCBF (AAA). (shown)

(ii) $\frac{BF}{EF} = \frac{BC}{ED}$

$\frac{4}{2} = \frac{BC}{3}$

$BC = 6$ cm

(iii) $\frac{\text{Area of } \Delta ADE}{\text{Area of } \Delta ABC} = \left(\frac{DE}{BC}\right)^2 = \left(\frac{3}{6}\right)^2 = \frac{1}{4}$

(iv) $\frac{\text{Area of } \Delta ADE}{\text{Area of } \Delta ABC} = \frac{1}{4}$

$\frac{1}{4} = \frac{120}{\text{Area of } \Delta ABC}$

Area of $\Delta ABC = 480$ cm^2

Area of $BCED = 480 - 120$

$= 360$ cm^2

(b) (i) $\frac{V_x}{V_y} = \frac{216}{729}$

$\frac{l_x}{l_y} = \frac{2}{3}$

(ii) $\frac{A_y}{A_x} = \frac{9}{4}$

$A_y = \frac{9}{4} \times 800 = 1800$ cm^2

(iii) $\frac{\text{Cost to paint } X}{\text{Cost to paint } Y} = \frac{4}{9}$

$\frac{\text{Cost to paint } X}{15.90} = \frac{4}{9}$

Cost to paint $X = \frac{4}{9} \times 15.90 = \$7.07$

6. (a) Volume of candle = vol of cylinder + vol of cone

$\pi(1.5)^2(10) + \frac{1}{3}\pi(1.5)^2(2)$

≈ 75.4 cm^3

(b) (i) 18 cm × 12 cm × 6 cm

(ii) Vol of rectangular box

$= 18 \times 12 \times 6 = 1296$

% of empty space in box

$= \frac{1296 - (75.398)(12)}{1296} \times 100\%$

$= 30.2\%$

Total internal surface area of a box

$= 2(18 \times 6) + 2(12 \times 6) + 2(18 \times 12)$

$= 792$ cm^2

7. (a) P = 2.6

(c) $x \approx 0.363 \pm 0.05$ or $\approx 1.761 \pm 0.05$

(d) $m = -3.75 \pm 0.05$

(e) (ii) $x \approx 0.127 \pm 0.05$ or $\approx 2.296 \pm 0.05$

Examination Paper 17

1. (a) $2^2 \times 3^3 \times 11$

(b) The powers of the prime bases are not multiples of 3.

2. (a) 0.021

(b) $188\frac{8}{9}\%$

3. (a) 6

(b) 1.2×10^{-2}

4. $5x^4 - 80 = 5(x^4 - 16)$

$= 5(x^2 + 4)(x^2 - 4)$

$= 5(x^2 + 4)(x + 2)(x - 2)$

5. $14 \le 3x + 2$

$12 \le 3x$

$4 \le x$

$3x + 2 < 21$

$3x < 19$

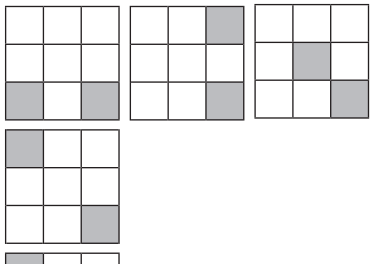
$x < \frac{19}{3}$

$4 \le x < \frac{19}{3}$

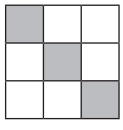
6. (a) Since $(36 - 9) = 27$ is not divisible by 4 or is not a multiple of 4, 36 is not a term

(b) 19th term $= 9 + 4(19) = 85$

7. (a)



(b)



8. (a) $\frac{3.6 \times 10^9}{114} \times 100 \approx 3.1578947 \times 10^9$

≈ 3158 million

(b) \$6013.19

9. (a) $\begin{pmatrix} 3 & 4 \\ 6 & 8 \end{pmatrix} - \frac{1}{2}\begin{pmatrix} 6 & -4 \\ 2 & 0 \end{pmatrix}$

$= \begin{pmatrix} 0 & 6 \\ 5 & 8 \end{pmatrix}$

(b) $\begin{pmatrix}4 & 2k\\0 & 0\end{pmatrix}=\begin{pmatrix}4 & -8\\0 & 0\end{pmatrix}$

$2k=-8$

$k=-4$

(c) $CD=\begin{pmatrix}2 & 1\\0 & 3\end{pmatrix}\begin{pmatrix}x & -1\\0 & 2\end{pmatrix}$

$=\begin{pmatrix}2x & 0\\0 & 6\end{pmatrix}$

$DC=\begin{pmatrix}x & -1\\0 & 2\end{pmatrix}\begin{pmatrix}2 & 1\\0 & 3\end{pmatrix}$

$=\begin{pmatrix}2x & x-3\\0 & 6\end{pmatrix}$

$CD = DC$

$\begin{pmatrix}2x & 0\\0 & 6\end{pmatrix}=\begin{pmatrix}2x & x-3\\0 & 6\end{pmatrix}$

$0=x-3$

$x=3$

10. (a) $\frac{\sin\angle CAD}{3}=\frac{\sin 60}{8}$

$\sin\angle CAD=0.32475$

$\angle CAD=18.950$

$\angle CAD=19.0°$

(b) Bearing of D from A = 40° + 70° + 18.95°

Bearing of D from A = 128.95°

Bearing of D from A ≈ 129.0°

11. (a) 2.96 (b) 7

(c) 10 (d) 0

12. (a) $y=\frac{1}{2}x-6$

(b) Gradient of $AB=\frac{q-(-6)}{-2-4}=\frac{q+6}{-6}$

$\frac{q+6}{-6}=\frac{1}{2}$

$2(q+6)=-6$

$2q+12=-6$

$q=-9$

(c) Length of $AB=\sqrt{[4+2]^2+[-6+9]^2}$

Length of $AB=\sqrt{45}$/6.71 units

13. (a) SGD$772

(b) $A=P(1+\frac{R}{100})^n$

$20000=P\,(1+\frac{8/4}{100})^{4\times10}$

$P=\frac{20000}{(1+\frac{2}{100})^{40}}$

P = $9058 (nearest dollar)

14. (a) (i) 6.25cm (ii) 62.5 cm^3

(b) 280 days

15. (a) (i) $-\frac{5}{13}$

(ii) $-\frac{12}{5}$

(iii) $\frac{12}{13}$

(b) (i) $OB=\sqrt{12^2+16^2}=20$ cm

(ii) $OM=\sqrt{OB^2-BM^2}=\sqrt{400-128}$

= 16.5 cm

16. (a) $\left(\frac{108}{360}\times\pi\times9^2\right)-\left(\frac{108}{360}\times\pi\times6^2\right)$

= 76.34 – 33.93

= 42.41 cm^2

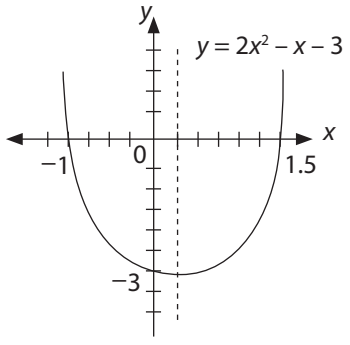
(b) (i) 2 cm

(ii) $(2\pi(2)\times4)+(8\times4)$

$=(16\pi+32)$ cm

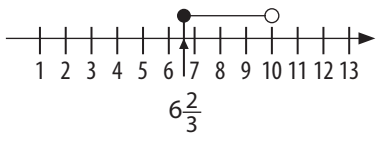
17. (a) (i) $x=1\frac{1}{2}$ or -1

(ii)



(b) (i) $x=-\frac{1}{4}, y=1\frac{1}{4}$

(ii)



18. (a) $1\frac{7}{8}$ m/s^2

(b) 1.25 m/s^2

(c) 10 seconds

(d) 1000 m

Examination Paper 18

1. (a) $m = \frac{7-(-3)}{-2-3} = -2$

   (b) $D = (2, 7)$

   (c) Area of $\Delta ABCD = 4 \times 10 = 40$ units^2

   (d) $DB = \sqrt{(2-3)^2 + (7-(-3))^2}$

   $= 10.05$ units

   (e) gradient of $DB = \frac{7-(-3)}{2-3} = -10$

   $y = -10x + c$

   Sub in $B(3, -3)$

   $-3 = -10(3) + c$

   $c = 27$

   $y = -10x + 27$

   $E = (-2, -3)$

2. (a) $AB = \sqrt{15^2 - 9^2}$ (Pythagoras' Theorem)

   $AB = 12$ cm

   (b) $VA = \sqrt{\left(\frac{15}{2}\right)^2 + 10^2}$

   $VA = 12.5$ cm

   (c) $\angle BVC = \cos^{-1} \frac{12.5^2 + 12.5^2 - 9^2}{2 \times 12.5 \times 12.5} = 42.2°$

   (d) $\tan \angle VBD = \frac{VM}{BM}$

   $\angle VBD = \tan^{-1} \frac{10}{\frac{15}{2}} = 53.1°$

3. (a) (i) $(x + y)(x - y)$

   $= x^2 - y^2$

   $= (-2)^2 - 0^2$

   $= 4$

   (ii) $35 - 4p > 1$

   $-4p > -34$

   $p < 8.5$

   Largest prime no. $p = 7$

   (b) (i) $m = 11$

   (ii) $\frac{(0 \times 10) + (1 \times 2) + (2 \times 7) + (3 \times 3) + (4 \times m) + (5 \times 3) + (6 \times 8)}{33 + m}$

   $= 3$

   $\frac{88 + 4m}{33 + m} = 3$

   $m = 11$

   (iii) $11 + m = 21$

   $m = 10$

4. (a) (i) 123454321, 25

   (ii) 81

   (iii) n^2

   (b) (i) 61 and 85

   (ii) $n^2 + (n + 1)^2$

   (iii) $n^2 + (n + 1)^2 = 2n^2 + 2n + 1$

   Even number + 1

   Therefore odd number.

5. (a) 9.33

   (b) (i) 14.4

   (ii) 74.4

   (c) 5.93

   (d) 766

6. (a) (i) Bearing of M from K $= 050° + 065°$

   Bearing of M from K $= 115°$

   (ii) $\frac{JM}{\sin 65°} = \frac{0.6}{\sin 50°}$

   $JM = 0.7098$

   $JM = 0.710$ km

   (iii) $LM^2 = 1.3^2 + 0.6^2 - 2(1.3)$

   $(0.6) \cos (180° - 65°)$

   $LM = 1.645$

   $LM = 1.65$ km

   (b) (i) Area of KLM

   $= \frac{1}{2}(1.3)(0.6) \sin(180° - 65°)$

   Area of $KLM = 0.3534$

   Area of $KLM = 0.353$ km^2

   (ii) $\frac{1}{2} \times 1.645 \times h = 0.3534$

   $h = 0.4296$

   $= 0.430$ km

   (c) $\tan \theta = \frac{0.4}{1.3}$

   Angle of depression $\theta = 17.10°$

   Angle of depression $\theta = 17.1°$

7. (a) $\frac{7.8 \times 10^{-9}}{10^3} = 7.8 \times 10^{-12}$

   (b) $\frac{90 \times 1000}{3600}$ m/s

   = 25 m/s

   (c) $3D + 4P = 13$ …(1)

   $4D + 3P = 15$ …(2)

   (1) × 4: $12D + 16P = 52$ …(3)

   (2) × 3: $12D + 9P = 45$ …(4)

   (3) – (4) $7P = 7$

   $1P = 1$

   Substitute $1P = 1$ into (1):

   $3D + 4(1) = 13$

   $3D = 9$

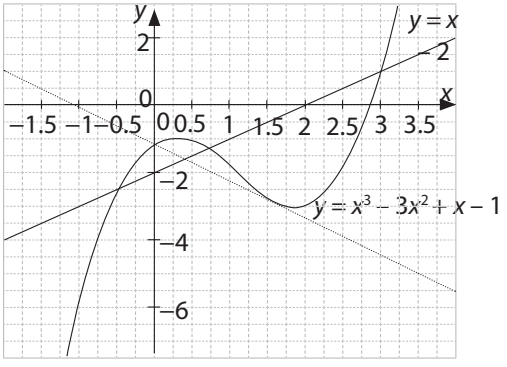
   $1D = 3$

8. (a) $a = -1.125$, $b = -3$

   (b) Correct scale + label axes

   Correct points plotted

   Correct shape of graph



   (c) $x^3 - 3x^2 + 1 = 0$

   $x^3 - 3x^2 + x - 1 = x - 2$

   Draw $y = x - 2$

   No. of solutions = 3

   (d) $y = -10 \pm 0.2, -3.0 \pm 0.2$

   (e) Draw tangent correctly at $x = 1.5$

   Calculate gradient from two points on tangent $m = -1.45$ to -0.9

9. (a) (i) At A, $x = 5$.

   Substitute $x = 5$ into the equation $y = -x + 9$:

   $y = -5 + 9 = 4$

   Ans: A(5, 4)

   (ii) At B, $x = 2$.

   Substitute $x = 2$ into the equation $y = -x + 9$:

   $y = -2 + 9 = 7$

   Ans: B(2, 7)

   (iii) At C, $y = 0$.

   Substitute $x = 0$ into the equation $y = -x + 9$:

   $y = -0 + 9 = 9$

   Ans: C(0, 9)

   (b) $AB = \sqrt{(5-2)^2 + (4-7)^2}$

   $AB = \sqrt{(3)^2 + (-3)^2} = \sqrt{18} = 4.24$ units

   (c) Area of the trapezium $ABST$

   $= \frac{1}{2} \times (AT + BS) \times TS$

   $= \frac{1}{2} \times (4 + 7) \times 3$

   = 16.5 cm²

Examination Paper 19

1. (a) 1.5336×10^4 (b) 852 km/h

2. $n^2 = \frac{b^2}{g - c}$

   $g - c = \frac{b^2}{n^2}$

   $c = g - \frac{b^2}{n^2}$

3. (a) Difference = 14 – (–4) = 18°C

(b) (i) No. of hours between 0900 and 1500 = 6

No. of hours between 0900 and 1300 = 4

6 h → 18°

4 h → 12°

Temperature at 1300

= –4° + 12° = 8°C

(ii) Difference in temperature = 16.5°

3° → 1 h

16.5° → 5.5 h

Time = 0900 + 5 h 30 min = 1430

4. The new students from 2009 to 2014 are not shown. Student intake from 2009 to 2014 could be very low, hence it may not show an overall increasing trend from 2005 to 2015.

5. (a) When $x = 4$ and $y = 0$,

$\frac{4}{h} + \frac{0}{k} = 1$

$h = 4$

When $x = 0$ and $y = -6$,

$\frac{0}{h} + \frac{-6}{k} = 1$

$k = -6$

(b) Gradient $= \frac{0-(-6)}{4-0} = \frac{6}{4} = \frac{3}{2}$

6. (a) $A(0, 4)$, $B(10, 0)$

(b) 8 units

(c) $y = -\frac{2}{5}x - \frac{9}{5}$ or $5y = -2x - 9$

7. (a) $1 - 2x \leq 5 + x$

$-2x \leq 4 + x$ and $5 + x < 13$

$-3x \leq 4$ $x < 8$

$x \geq -\frac{4}{3}$

$x \geq -1\frac{1}{3}$

$-1\frac{1}{3} \leq x < 8$

(b) (i) 7 (ii) $-1\frac{1}{3}$

8. $\frac{6a^4c^3}{4b^2d^3} \div \frac{12c^3d^{-2}}{30a^8b^{10}} = \frac{6a^4c^3}{4b^2d^3} \times \frac{30a^8b^{10}}{12c^3d^{-2}}$

$= \frac{15a^{12}b^8}{4d}$

9. (a) $x = 2$

(b) $p = -7\frac{1}{3}$

10. $PC = AC$ (sides of square $ACPQ$)

$BC = RC$ (sides of square $BCRS$)

$\angle PCA = \angle BCR = 90°$ ($\angle$s of square)

$\angle PCB = \angle ACB + 90°$

$\angle ACR = \angle ACB + 90°$

$\rightarrow \angle PCB = \angle ACR$

$\therefore \Delta BPC \equiv \Delta RAC$ (SAS)

11. (a) $x^2(x - 3) - 4(x - 3)$

$= (x - 3)(x^2 - 4)$

$= (x - 3)(x + 2)(x - 2)$

(b) $(2x - 1)(x + 10)$

(c) $3a^2 - 12b^2 - 4ac - 8bc$

$= 3(a^2 - 4b^2) - 4c(a + 2b)$

$= 3(a + 2b)(a - 2b) - 4c(a + 2b)$

$= (a + 2b)(3a - 6b - 4c)$

12. (a) $\cos 35° = \frac{AD}{42.7}$

$AD = 42.7 \cos 35°$

$AD = 35.0$ cm

(b) $AE = 42.7 \sin 35° = 24.5$ cm

$\tan \angle BEC = \frac{BC}{BE} = \frac{AD}{BE} = \frac{35}{16.1 + 24.5}$

$\angle BEC = 40.75°$

$\angle AED = 180° - 90° - 35° = 55°$ ($\angle$ sum of Δ)

$\angle DEC = 55° - 40.75° = 14.25°$

13. (a) Using Pythagoras' Theorem,

$BC = \sqrt{41^2 - 40^2} = 9$ cm

(b) $\sin \angle ABD = \sin \angle CBD$

$= \frac{AD}{BE}$

$= \frac{40}{41}$

(c) Using Pythagoras' Theorem:

$AD = \sqrt{30^2 + 40^2} = 50$ cm

$\cos \angle ADB = \frac{41^2 + 50^2 - 21^2}{2(41)(50)} = \frac{187}{205}$

14. (a) 190°

(b) 286°

(c) 058°

15. (a) $y \propto (2x - 1)$

$y = k(2x - 1)$

When $x = 3$, $y = y_1$:

$y_1 = k(6-1) = 5k$

When $x = 8$, $y = y_2$:

$y_2 = k(16-1) = 15k$

$y_2 - y_1 = 15k - 5k = 5$

$\rightarrow k = \frac{5}{10} = \frac{1}{2}$

$\therefore y = \frac{1}{2}(2x - 1)$

(b) When $y = 7$:

$7 = \frac{1}{2}(2x - 1)$

$14 = 2x - 1$

$15 = 2x$

$\therefore x = 7.5$

16. (a) 76° (b) 104°

(c) 14° (d) 76°

17. (a) $OP = \sqrt{2.8^2 + 4.4^2} \approx 5.215$ cm

$PQ = 5.215 - 2.8 \approx 2.41$ cm

(b) $\tan \angle APO = \frac{2.8}{4.4}$

$\angle APO \approx 32.47$

$\angle APB \approx 2(32.47) \approx 64.9$

18. (a) Rearranging:

$(x - 2), (x - 1), (x - 1), (x + 2), (x + 3), (x + 5), (x + 8)$

Mode $= x - 1$

Median $= x + 2$

$(x - 1) + (x + 2) = 17$

$x = 8$

(b) 6, 7, 7, 10, 11, 13, 16

Lower quartile = 7

Upper quartile = 13

Interquartile range = 13 – 7 = 6

(c) P(selecting a number that is between 7 and 14)

$= P(10, 11, 13)$

$= \frac{3}{7}$

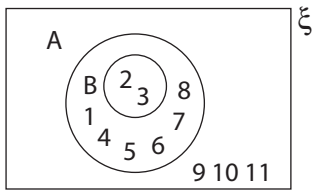
19. (a) $\xi = (x : x$ is a natural number, $0 < x < 12) = (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11)$

$B = (x : x$ is a prime number that is smaller than 5) $= (2, 3)$

$A = \left(\frac{1}{4}x + 7 < 10\right) = (x < 9)$

$= (1, 2, 3, 4, 5, 6, 7, 8)$

(b)



(c) All the possible subsets of B

= (2), (3), (2, 3)

(d) $A \cap B' = (1, 4, 5, 6, 7, 8)$

20. (a) $\frac{5}{(x+1)(x-1)} - \frac{x}{x+1}$

$= \frac{5 - x(x-1)}{(x+1)(x-1)}$

$= \frac{5 - x^2 + x}{(x+1)(x-1)}$

(b) $2(9x^2 - 12x + 4) - 3x^2 + 3x + 4$

$= 15x^2 - 21x + 12$

21. Cake A: \$31.80/750 g = \$0.0424/g

Cake B: \$43.80/1250 g = \$0.03504/g

Cake B is better value for money as it is cheaper by \$0.0073/g

Examination Paper 20

1. (a) $C = \begin{pmatrix} 0.45 & 0.65 & 0.70 \\ 0.22 & 0.40 & 0.25 \end{pmatrix}$

   (b) $AC = (1\ 1)\begin{pmatrix} 0.45 & 0.65 & 0.70 \\ 0.22 & 0.40 & 0.25 \end{pmatrix}$

   $= (0.45 + 0.22\ 0.65 + 0.40\ 0.70 + 0.25)$

   $= (0.67\ 1.05\ 0.95)$

   (c) Total cost for each type of noodles. / Total cost of each bowl of different types of noodles.

   (d) $\begin{pmatrix} 300 \\ 180 \\ 240 \end{pmatrix}$

   (e) $CN = \begin{pmatrix} 0.45 & 0.65 & 0.70 \\ 0.22 & 0.40 & 0.25 \end{pmatrix}\begin{pmatrix} 300 \\ 180 \\ 240 \end{pmatrix} = \begin{pmatrix} 420 \\ 198 \end{pmatrix}$

   (f) Cost of ingredients and labour respectively for all types of noodles sold in one day.

2. (a) (i) 50°

   (ii) 100°

   (iii) 65°

   (iv) 40°

   (b) 2.30

   (c) SSS, SAS, ASA, AAS, RHS

3. (a) $(x + 10)$ km/h

   (b) (i) $\left(\frac{90}{x} + \frac{90}{x+10}\right)$ h

   (ii) $\left(\frac{180}{x+10}\right)$ h

   (c) $\left(\frac{90}{x} + \frac{90}{x+10}\right) - \left(\frac{180}{x+10}\right) = \frac{18}{60}$

   $\frac{90x + 900 + 90x}{(x)(x+10)} - \frac{180x}{(x)(x+10)} = \frac{3}{10}$

   $\frac{900x}{x^2 + 10x} = \frac{3}{10}$

   $3x^2 + 30x - 9000 = 0$

   $x^2 + 10x - 3000 = 0$

   (d) $(x - 50)(x + 60) = 0$

   $x = 50, -60$ (rejected)

   (e) (i) $\left(\frac{180}{50+10}\right)$ h $= 3$h

   (ii) $\left(\frac{90}{50} + \frac{90}{50+10}\right)$ h $= 3.3$ h

   Average speed $= \frac{180 \text{ km}}{3.3 \text{ h}}$

   $= 54.5$ km/h

4. (a) 3.2

   (b) 352.4 cm^2

   (c) 5.38 cm

5. (a) $\frac{120 \times 3}{100} = 3.6$months

   (b) (i) $\sqrt{5.0 \times 10^4 + 5.0 \times 10^4}$

   $= \sqrt{10^4}$

   $= 316.22$ m

   $= 316$ m

   (ii) $\frac{3 \times 3.0 \times 10^6}{5.0 \times 10^4} = 180$ m

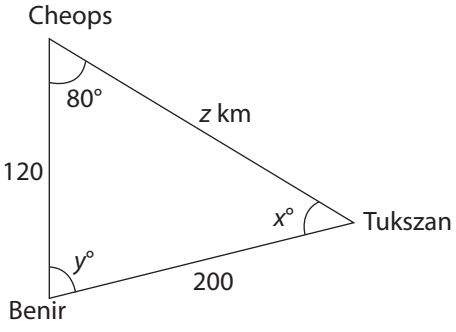
   (c) (i) $\frac{35}{\sin 9°} = 223.7$ m

   $= 224$ m

   (ii) $\frac{10}{\sin 9°} = 63.9$ m

   (iii) The length of the platform to reach the vertex of the pyramid $\frac{180}{\sin 9°} = 1150$ m $= 1.15$ km, which would be too long for a platform to be constructed.

(d)



$\frac{\sin x}{200} = \frac{\sin 80°}{200} \rightarrow x = 36.219$

$y = 180° - 80° - 36.219°$

$= 63.781°$

$\frac{z}{\sin 63.78} = \frac{200}{\sin 80°}$

$z = 182$ km

Tukszan is 180 km from Cheops.

6. (a) $5k + 3 < 26$

$k < \frac{23}{5} = 4\frac{3}{5}$

Largest prime number $k = 3$

(b) (i) Smallest $(3x - 2y)$

$= 3(-4) - 2(8)$

$= -12 - 16$

$= -28$

(ii) Smallest $(x^2 + y^2) = 0^2 + 2^2 = 4$

(iii) Largest $\left(\frac{x-y}{y}\right) = \frac{4-2}{2} = 1$

7. (a) $a = 6.33$, $b = -5$

(c) $x = 1.6$ (±0.1)

(d) $x = 1.9$ and 8.7 (±0.1)

(e) -5.2 (±0.1)

(f) $x = 5$

8. (a) (i) $\frac{737}{27}$

$= 27.296$

≈ 27.3 (3 s.f.)

(ii) 28

(iii) 32

(b) $\frac{11}{27} \times 100\%$

$= 40.7\%$ (3 s.f.)

(c) Mathematics, because the median mark is 28 marks, which is higher than the median mark for Science Weighted Assessment, which is 26 marks.

(d) $\frac{11}{27}$

(e) The mean will increase by 2 marks. The range will remain the same.